AD-A144 549 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/2
WHITING RIVER DAM (CT..(U) CORPS OF ENGINEERS WALTHAM
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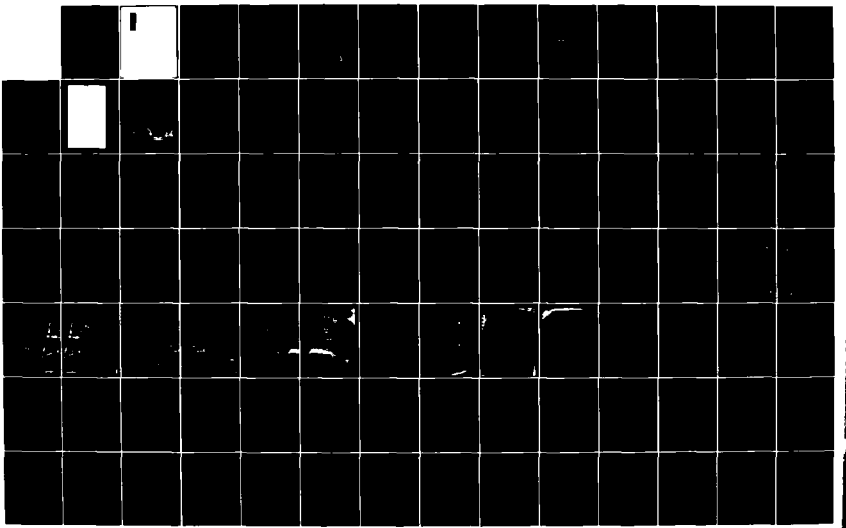

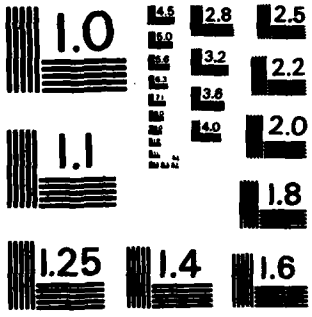

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

DAMS, INSPECTION, DAM SAFETY,

Housatonic River Basin
North Canaan, Connecticut

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The Whiting River Dam is a single purpose flood control dam. The dam consists of a zoned earth embankment with a maximum height of 80 feet, a top width of 14 ft. an upstream slope of 4 horizontal to 1 vertical, and a downstream slope of 3 horizontal to 1 vertical. Based on the visual inspection and a review of all available pertinent data, the condition of the dam is judged to be good. The dam is classified as "Intermediate" in size with a "High" hazard potential. A test flood equal to the PMF was used to evaluate the spillway capacity.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED

JUN 10 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Whiting River Dam (CT-00483) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the owner and cooperating agency for the State of Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

WHITING RIVER DAM
CT 00483

HOUSATONIC RIVER BASIN
NORTH CANAAN, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

IDENTIFICATION NO: CT 00483

NAME OF DAM: Whiting River Dam

TOWN: North Canaan

COUNTY AND STATE: Litchfield County, Connecticut

STREAM: Whiting River

DATE OF INSPECTION: November 17, 1980

BRIEF ASSESSMENT

The Whiting River Dam is a single purpose flood control dam. The dam consists of a zoned earth embankment with a maximum height of 80 feet, a top width of 14 feet, an upstream slope of 4 horizontal to 1 vertical, and a downstream slope of 3 horizontal to 1 vertical. The dam is 580 feet long and has a grass-covered 250 foot emergency spillway excavated into the left abutment. The principal spillway is of the drop inlet type and discharges through a reinforced concrete conduit through the center of the dam. The dam, constructed on a pervious foundation, has a central impervious core, and a drainage system under the downstream portion of the embankment. As the dam is used for flood control, the impoundment remains at the principal spillway level except during periods of heavy runoff. The impoundment has a maximum storage capacity of 5,000 Acre-Feet.

Based on the visual inspection and a review of all available pertinent data, the condition of the dam is judged to be good. The impoundment has never been substantially filled so the behavior of the structure under full hydrostatic loading conditions is unknown. The future integrity of the dam could be affected by the

construction of the right side of the emergency spillway on fill, the location of the emergency spillway in the vicinity of the downstream toe of the dam, and the settlement and erosion of the stone drains at the abutments.

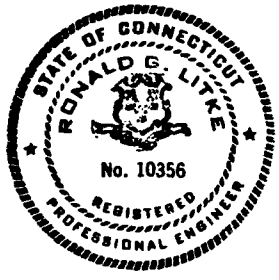
Based on the Corps of Engineer's Recommended Guidelines for Safety Inspection of Dams, the dam is classified as "Intermediate" in size with a "High" hazard potential. A Test Flood equal to the Probable Maximum Flood (PMF) was used to evaluate the spillway capacity. The Test Flood inflow of 26,000 cubic feet per second (cfs) was routed through the impoundment and produced an outflow of 16,800 cfs. The spillway capacity with the water level at the top of the dam is 14,800 cfs, 88 percent of the routed Test Flood outflow. The Test Flood would overtop the dam by 0.5 feet.

It is recommended that a qualified, registered engineer be retained to investigate the potential for erosion of the emergency spillway; the erosion or settlement of the stone drains at the abutments; the possible settlement of the inlet structure; and the significance of cracks previously reported in the outlet conduit. In addition, the dam should be inspected by a qualified, registered engineer during each period of significant flood impoundment, the Soil Conservation Service's Operations and Maintenance Handbook should be provided to the dam's operator, records of water levels should be kept, a downstream warning system should be developed, and the animal burrows present on the dam should be backfilled.

The owner should implement these recommendations as described herein and in greater detail in Section 7 of the Report within two years after receipt of this Phase I Inspection Report.

Ronald G. Litke, P.E.
Project Engineer

Roald Haestad
President



This Phase I Inspection Report on Whiting River Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechmical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the

condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety of the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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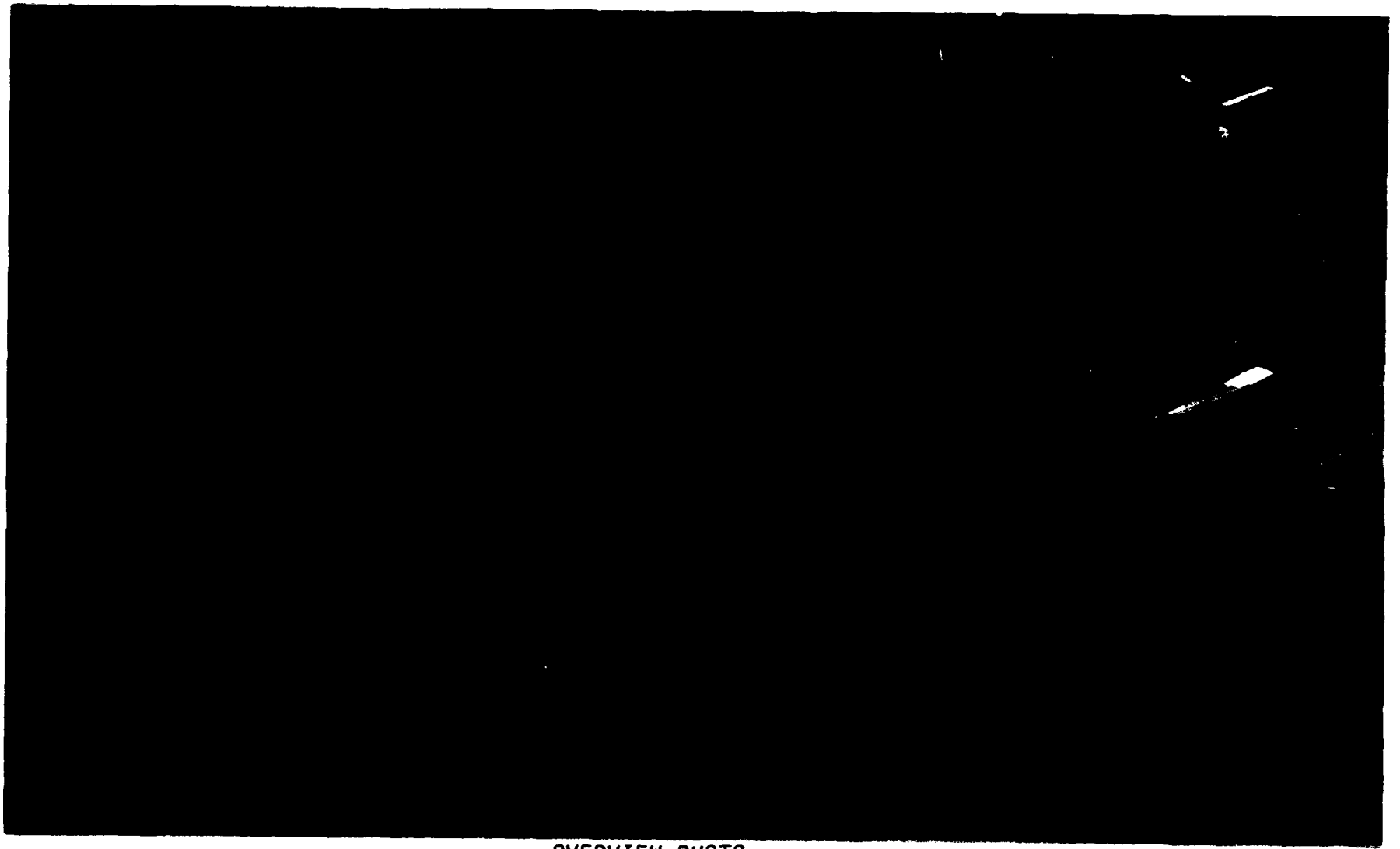
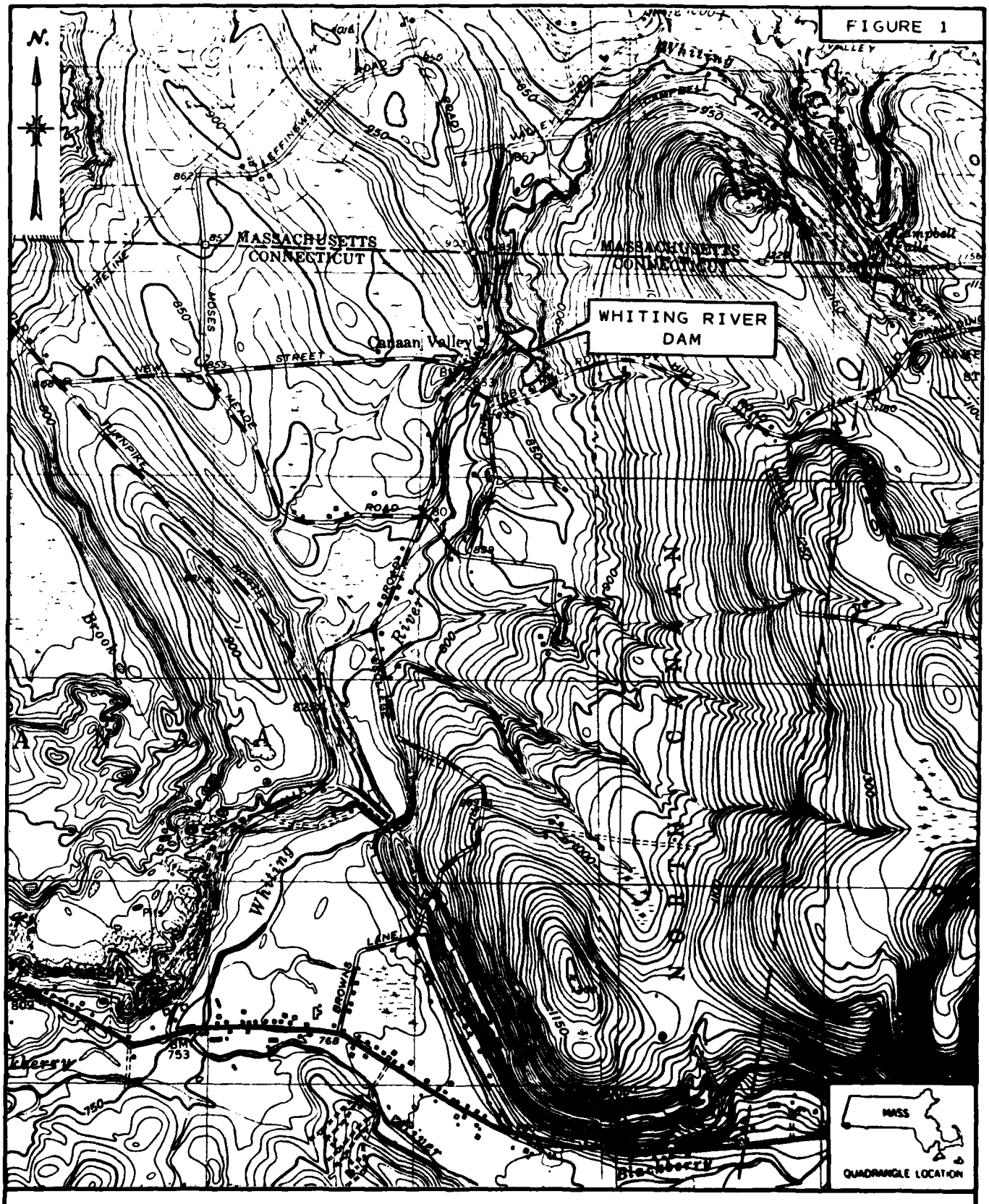


OVERVIEW PHOTO

U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM - CT 00483
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		WHITING RIVER
		NORTH CANAAN, CONNECTICUT 13 NOVEMBER 1980

FIGURE 1



LOCATION PLAN

WHITING RIVER DAM
NORTH CANAAN, CONNECTICUT

ROALD HAESTAD, INC.

SCALE 1:25,000

ASHLEY FALLS
QUADRANGLE 1969

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

WHITING RIVER DAM

PROJECT INFORMATION
SECTION 1

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Roald Haestad, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Roald Heastad, Inc., under a letter of October 28, 1980, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-0005 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The Whiting River Dam, also known as the Blackberry River Watershed Floodwater Retarding Dam No. 15, is located on the Whiting River about 3 miles upstream of the confluence with the Blackberry River, approximately 1,500 feet south of the Connecticut - Massachusetts State Line, and about 700 feet north of Canaan Valley in the Town of North Canaan, Connecticut. The dam is shown on the Ashley Falls Massachusetts - Connecticut U.S.G.S. Quadrangle Map having coordinates of latitude N 42°02.5' and longitude W 73° 15.3'.

b. Description of Dam and Appurtenances

The Whiting River Dam is a flood control dam; the impoundment remains at the principal spillway level except during periods of heavy runoff.

The dam consists of a compacted earth embankment on a pervious foundation with a maximum height of 80 feet, a top width of 14 feet, an upstream slope of 4 horizontal to 1 vertical, and a downstream slope of 3 horizontal to 1 vertical. Berms are present on both the upstream and downstream slopes. Plans indicate the dam has an impervious core and cut-off trench consisting of clay and silty clay; a downstream embankment consisting of coarse silty sand and poorly graded sand; and an upstream embankment consisting of silts and silty sands. A filter drain was reportedly constructed just downstream from the core extending from the toe to the top of the core. The drain discharges through a rock fill at the toe. The embankment is protected with a good growth of sod. The dam crest is 580 feet long.

The principal spillway consists of a reinforced concrete drop inlet and 3.5' x 3.5' conduit through the center of the dam,

and an S.A.F. (St. Anthony Falls) sloping apron type energy dissipator on the downstream end, also of reinforced concrete. The drop inlet structure has a 9.67 foot long overflow weir on the left and right sides, and a 30-inch low level outlet sluice gate on the upstream side which drains the sediment pool. An emergency spillway has been excavated into the left abutment. The emergency spillway is 250 feet long and is separated from the dam by a riprapped dike. The top width of the dike is 10 feet and the side slopes are 2 horizontal to 1 vertical. The cut slope at the left abutment is 2-1/2 horizontal to 1 vertical. The emergency spillway is grass-covered and has a 100 foot wide level control section with a 1.75 percent slope on the discharge channel. The crest of the dam is 67.6 feet above the drop inlet spillway and 7.3 feet above the emergency spillway.

c. Size Classification - "Intermediate"

According to the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, a dam is classified as "Intermediate" in size if the height is between 40 feet and 100 feet or the dam impounds between 1,000 Acre-Feet and 50,000 Acre-Feet. The Whiting River River has a maximum height of 80 feet and a maximum storage capacity of 5,000 Acre-Feet. Therefore, the dam is classified as "Intermediate" in size.

d. Hazard Classification - "High"

Based on the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the hazard classification for the dam is "High". A dam failure analysis indicates that a breach of the Whiting River Dam could result in the loss of more than a few

lives and economic loss due to downstream flooding of homes and highways.

The calculated dam breach would release up to 119,000 cfs into the Whiting River. Approximately 6,500 feet downstream of the dam an abandoned railroad embankment would limit the downstream discharge and cause the floodwaters to pond upstream, inundating 10 - 15 homes up to a depth of 20 feet. Downstream of the railroad embankment the flood waters would overtop U.S. Route 44 and flood adjacent structures to a depth of up to 7 feet.

The maximum project discharge capacity, prior to dam breach, exceeds the capacity of the downstream culverts and would overtop the roadways up to a depth of 7 feet. The backwaters from the railroad embankment would inundate 3 - 5 homes up to a depth of 2 feet. U.S. Route 44 would be overtopped and adjoining structures would be flooded up to a depth of 2 feet.

e. Ownership

The State of Connecticut
Department of Environmental Protection
Water and Related Resources
State Office Building
Hartford, Connecticut 06115

Benjamin Warner, Director of Water Resources
(203) 566-7220

f. Operator

Anthony Cantele
P.O. Box 161
Pleasant Valley, Connecticut 06063
(203) 379-0771

g. Purpose of Dam

The dam is a single purpose structure designed to provide flood protection to the Blackberry River flood plain.

h. Design and Construction History

The dam was designed in 1963 by the Soil Conservation Service, U.S. Department of Agriculture, for the State of Connecticut. The dam was designed to contain a storm of the magnitude of Hurricane "Diane" (1955) without emergency spillway flow. The dam was constructed in 1966 - 1968 by Welsh and Core Construction Company of Westfield, Massachusetts, under the supervision of the Soil Conservation Service.

In 1978 drains were installed behind the outlet structure wing walls and expansion joints repaired to correct settlement of the walls.

i. Normal Operational Procedures

The site is reportedly visited by exployees of the State Department of Environmental Protection during periods of heavy runoff. The DEP Office in Hartford would be contacted if any problems were noted. No measurements have been taken or records kept of past impoundment depths. The impoundment has never been substantially filled.

1.3 Pertinent Data

a. Drainage Area

The drainage area consists of 14.14 square miles of "mountainous" terrain with steep slopes, three ponds of significant size, including one flood control dam, and several swamps. The area is wooded with almost no development.

b. Discharge at Damsite

Water normally discharges over the weir of the principal spillway. Outlet works consist of reinforced concrete drop inlet spillway, outlet conduit and energy dissipator. A grass-covered emergency spillway has been excavated into the left abutment.

1.	Outlet Works (conduits) Size:	3.5' x 3.5' reinforced concrete
	Invert Elevation:	803.0 (Drop Inlet El. 811.0)
	Discharge Capacity:	340 cfs @ Pool El. 875.8
2.	Maximum Known Flood at Damsite:	Unknown
3.	Ungated Spillway Capacity* at Top of Dam:	14,800 cfs
	Elevation:	878.6
4.	Ungated Spillway Capacity* at Test Flood Elevation:	16,250 cfs
	Elevation:	879.1
5.	Gated Spillway Capacity at Normal Pool Elevation:	N/A
	Elevation:	
6.	Gated Spillway Capacity at Test Flood Elevation:	N/A
	Elevation:	
7.	Total Spillway Capacity* at Test Flood Elevation:	16,250 cfs
	Elevation:	879.1
8.	Total Project Discharge* at Top of Dam:	14,800 cfs
	Elevation:	878.6
9.	Total Project Discharge* at Test Flood Elevation:	16,800 cfs
	Elevation:	879.1

*Including Emergency Spillway

c. Elevation - Feet Above Mean Sea Level (NGVD)

1.	Streambed at Toe of Dam:	798.7
2.	Bottom of Cutoff:	796±
3.	Maximum Tailwater:	802.8 @ 400 cfs
4.	Normal Pool:	811.0
5.	Full Flood Control Pool:	871.3 Emergency Spillway
6.	Spillway Crest:	811.0 Principal Spillway
7.	Design Surcharge - Original Design:	875.8
8.	Top of Dam:	878.6
9.	Test Flood Surcharge:	879.1

d. Reservoir - Length in Feet

1.	Normal Pool:	1,400
2.	Flood Control Pool:	9,000 Emergency Spillway
3.	Spillway Crest Pool:	1,400 Principal Spillway
4.	Top of Dam:	10,000
5.	Test Flood Pool:	10,000

e. Storage - Acre-feet

1.	Normal Pool:	27
2.	Flood Control Pool:	3,630 Emergency Spillway
3.	Spillway Crest Pool:	27 Principal Spillway
4.	Top of Dam:	5,000
5.	Test Flood Pool:	5,100

f. Reservoir Surface - Acres

1.	Normal Pool:	5
2.	Flood-Control Pool:	165 Emergency Spillway
3.	Spillway Crest:	5 Principal Spillway
4.	Test Flood Pool:	215
5.	Top of Dam:	215

g. Dam

1.	Type:	Zoned Earth Embankment Drop Inlet Principal Spillway Grassed Emergency Spillway
2.	Length:	580'
3.	Height:	80'
4.	Top Width:	14'
5.	Side Slopes:	4 horizontal to 1 vertical - upstream 3 horizontal to 1 vertical - downstream
6.	Zoning:	Impervious core and cut-off trench; silt and silty sand upstream embankment; coarse silty sand and poorly graded sand downstream embankment.
7.	Impervious Core:	Clay and silty clay compacted to 95% Proctor (modified)
8.	Cutoff:	20' - 30' wide at bottom; 1 to 1 side slopes; clay and silty clay
9.	Grout Curtain:	None
10.	Other:	A filter drain was constructed downstream of the core and connected to a rock toe drain.

h. Diversion and Regulating Tunnel - N/A

i. Spillway

	PRINCIPAL	EMERGENCY
1. Type:	Reinforced concrete drop inlet, conduit through the dam and energy dissipator	Earth cut in left abutment; some fill on right side; grass-covered

i. Spillway (cont'd)	PRINCIPAL	EMERGENCY
2. Length of Weir:	19.33'	250'
3. Crest Elevation with Flashboards: without Flashboards:	 N/A 811.0	 N/A 871.3
4. Gates:	N/A	N/A
5. Upstream Channel:	N/A	Grassed natural slope
6. Downstream Channel:	Straightened river channel	Grassed 1.75% slope
7. General:		100' level control section

j. Low Level Outlet:	
1. Invert:	804.5
2. Size:	30-inch
3. Description:	Corrugated metal pipe to drop inlet structure
4. Control Mechanism:	30-inch sluice gate
5. Other:	Used to drain sedimentation pool

ENGINEERING DATA
SECTION 2

2.1 Design Data

Available information which was reviewed included the design report, As-Built Plans and general correspondence. The dam was designed and constructed under the supervision of the Soil Conservation Service, U.S. Department of Agriculture. The design report was incomplete as it did not contain either emergency spillway discharge capacity computations or the design outflow hydrographs. However, copies of the emergency spillway hydrograph and the freeboard hydrograph were found in the State of Connecticut Department of Environmental Protection's correspondence file. The design report did contain a geologic report, boring logs, a soil report, hydraulic/hydrologic computations, and structural computations for the intake structure, conduit and energy dissipator.

2.2 Construction Data

As-Built Plans with changes from the original design noted were available and reviewed. Contract records including change orders, photographs and soil test results are reported to be stored at the Federal Archives and Record Center, but were not available for review.

2.3 Operational Data

The site is visited during periods of heavy runoff, but no depth readings are made or records kept.

2.4 Evaluation of Data

a. Availability

Existing data are available at the Soil Conservation Service, U.S. Department of Agriculture, Storrs, Connecticut, the Federal Archives and Record Center, Waltham, Massachusetts, and at the Department of Environmental Protection, Hartford, Connecticut.

b. Adequacy

The information which was avialable, along with the visual inspection and the hydraulic/hydrologic calculations made for this report, were not adequate to assess the condition of the dam. As the impoundment has never been filled and the dam has never been observed under full hydrostatic load, no comments on the performance of the dam under such loading can be made.

c. Validity

The field inspection indicated that the dam was constructed substantially as shown on the As-Built Plans.

VISUAL INSPECTION

SECTION 3

3.1 Findings

a. General

The visual inspection of the dam was conducted on November 17, 1980. The low level outlet or blowoff was closed and the water level was 0.1 feet above the crest of the drop inlet principal spillway. The general condition of the dam at the time of inspection was good.

The dam consists of an earth embankment with a drop inlet principal spillway located near the center of the dam and an emergency earth spillway excavated into the left abutment.

b. Dam

The upstream and downstream slopes and the crest of the dam are grass-covered, Photos 1, 2, 3 and 4. The grass is in good condition and has been well maintained. Motorcycle paths are present on both the upstream and downstream slopes as well as on the left abutment, Photos 5 and 6. There is a concrete footpath on the upstream slope from the crest to the intake structure. The crest and slopes appear even and straight with no indications of movement or sloughing. Several animal burrows approximately 6-inches in diameter were observed on the downstream slope. Berms are present on both the upstream and downstream slopes and are graded to divert surface drainage to stone drains at the intersection of the slopes with the abutments, Photo 7. Standing water was observed at the upstream berm, possibly indicating improper grading of the berm. Some settlement or erosion has taken place in the stone drains. A

depression in the stone drain about 2 feet wide and 1.5 feet deep was noted at about mid-height of the right downstream abutment, Photo 8. No seepage, wet or spongy areas were noted on the downstream slope or in the area downstream of the dam.

The dam was designed and constructed with an overfill of up to 2.5 feet over the higher portions of the embankment to compensate for anticipated settlement. Field surveys performed for this investigation show little or no settlement has taken place.

c. Appurtenant Structures

The appurtenant structures consist of the principal spillway and outlet works and the emergency spillway. The inlet structure is constructed of reinforced concrete and is in good condition. The top pipes of the trash racks on each side of the structure are not level, and give the impression that the structure has settled. The elevation of the four corners and of the crest were checked and the structure found to be about 0.1 foot lower at the upstream end. There was some debris in the structure at the time of inspection. The 30-inch blowoff is controlled by a manually operated gate mounted on the upstream side of the drop inlet structure, Photo 9, and was closed at the time of inspection. With the low level outlet closed the impoundment rises to the height of the drop inlet crest and submerges the area between the embankment and the inlet structure, making access to the structure difficult.

The drop inlet connects to a reinforced concrete conduit through the dam which discharges through an energy dissipator at the downstream toe. The conduit was not observed but it was reported that two internal cracks were observed in 1977. (See notes on Plan,

page B-6 in Appendix B.) The energy dissipator is of the sloping apron type constructed of reinforced concrete with baffle blocks on the floor and a riprapped stilling basin at the outlet, Photo 10. The concrete at the energy dissipator was in good condition, however, there appears to have been movement at the construction joints of the wing walls. The joint at the right wing wall was open 1.5 inches at the water line, Photo 11. The top of the joint has been filled with an asphaltic compound as part of reported repairs to the wing walls in 1978.

The emergency spillway consists of a 250 foot long section excavated into the left abutment and separated from the dam by an earth embankment with a riprapped slope on the spillway side, Photo 13. The spillway discharges high on the left abutment just downstream of the dam. The level control section of the spillway and a portion of the discharge channel are being used as a softball field and the grass is mowed relatively short in comparison to the remaining portion of the emergency spillway. See Overview Photo, page xi, and Photo 14. Bare spots are present at the bases of the ballfield. The remains of a snow fence, reportedly used as a home run fence for the softball field, were found lying at the downstream end of the spillway discharge channel.

d. Reservoir Area

No indications of instability were observed along the edges of the reservoir in the vicinity of the dam.

e. Downstream Channel

The downstream river channel was enlarged and straightened for several hundred feet downstream of the dam, Photo 12. Some trees overhang the channel 200 or more feet below the dam.

3.2 Evaluation

On the basis of the visual inspection the dam is judged to be in good condition. The following features could affect the future integrity of the dam:

1. Continued erosion or settlement of the stone drains at the abutments could lead to further erosion of the embankment and eventual breach of the dam.
2. Continued use of the emergency spillway as a softball field and its associated mowing reduces the friction coefficient and encourages flow concentration on the right side. This would cause velocities in excess of the allowable and could cause erosion of the spillway. The installation of a snow fence across the spillway could seriously obstruct flow and lead to concentrated areas of flow, causing erosion and/or overtopping of the dam.
3. The location of the discharge for the emergency spillway could cause erosion of the toe of the dam.
4. Animal burrows present on the slopes of the dam could provide seepage paths during periods of high water.
5. The sloping appearance of the intake structure and the reported cracks in the outlet conduit may indicate settlement of the structures.
6. The debris in the inlet structure could obstruct the conduit.
7. It should be emphasized that the impoundment has never been filled much above the level of the upstream berm, Elev. 830, and then only for short periods of time as reported by the SCS. Therefore, no observations have been made as to seepage through the dam or its behavior under full hydrostatic loading conditions.

OPERATIONAL AND MAINTENANCE PROCEDURES

SECTION 4

4.1 Operational Procedures

a. General

The Whiting River Dam is a single purpose flood control dam. The impoundment remains at the principal spillway level except during periods of heavy runoff. The dam has no operating facilities with the exception of a 30-inch low level outlet sluice gate at the principal spillway to allow for draining the sediment pool. Both the principal spillway and the emergency spillway are designed to function without human assistance. The principal spillway limits discharges and causes excess flows to be stored in the impoundment until the emergency spillway level is reached, and additional discharges occur. When the inflow falls below the discharge rate the water level drops and eventually empties through the principal spillway. The design computations give the drawdown time to be 10.2 days from design high water (El. 875.8, 4.5 feet above emergency spillway). The dam is inspected annually by representatives of the State of Connecticut Department of Environmental Protection and engineers from the Soil Conservation Service. See Appendix B, page B-72.

b. Description of Any Warning System in Effect

There is no formal warning system in effect. The dam is reportedly monitored by DEP personnel during heavy runoff. Any problems noted would be reported to the Department of Environmental Protection in Hartford.

4.2 Maintenance Procedures

a. General

The grass is mowed and the brush cut at least once a year.

The area of the emergency spillway is used as a softball field and the grass is kept short.

An Operation and Maintenance agreement was made between the State of Connecticut and the Soil Conservation Service at the time of construction. An Operations and Maintenance Handbook is also available from the Soil Conservation Service. The Handbook lists operating procedures and maintenance items to be performed.

b. Operating Facilities

The trash racks of the principal spillway are cleaned as required. At the time of inspection the 30-inch low level outlet gate was closed and water was discharging over the weir of the principal spillway.

4.3 Evaluation

Present operation and maintenance procedures are adequate. Copies of the Operations and Maintenance Handbook should be provided to the operators for their implementation. A downstream warning system should be developed and put into effect in case of an emergency at the dam.

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

SECTION 5

5.1 General

The outlet works at Whiting River Dam consist of a principal spillway of the drop inlet type discharging through the center of the dam, and an emergency spillway excavated into the left abutment. The principal spillway consists of a monolithic reinforced concrete box culvert, 3.5 feet square, with 12-inch chamfers in the corners, a reinforced concrete riser with a 9.67 foot long overflow weir on the left and right sides, and 30-inch low level outlet at the upstream side. The conduit outlets through a flared concrete transition channel and an S.A.F. (St. Anthony Falls) energy dissipator. The conduit has 14 anti-seep collars to prevent seepage.

The emergency spillway is an earth-cut through a silty sand in the left abutment and has a grass surface cover. The emergency spillway is separated from the dam embankment by a dike riprapped on the spillway side. The dike has a top width of 10 feet and side slopes of 2 horizontal to 1 vertical. Both the dike and the right side of the emergency spillway are constructed on fill. The 250 foot spillway has a 100 foot level control section, a 2.5 to 1 side slope at the left abutment, and a 2 to 1 slope at the right side. The spillway is used as a softball field and the grass is kept short.

The capacity of the principal spillway was calculated to be about 340 cfs at design high water El. 875.8. The emergency spillway was calculated to have a capacity of about 6,600 cfs at design high water and about 14,500 cfs at the top of the dam El. 878.6. Total spillway capacity at the top of the dam is about 14,800 cfs.

The dam has a watershed of 14.14 square miles of essentially undeveloped wooded terrain. The watershed has very steep slopes, three ponds of significant size, including one flood control dam and several swamps located throughout the watershed. Elevations vary from about 1,700 feet on the east side of the watershed to 810 feet at the dam.

5.2 Design Data

The dam was designed by the Soil Conservation Service, U.S. Department of Agriculture, for the State of Connecticut. The design computations and correspondence files were available for review. The files were found to be incomplete in that they lacked computations for the emergency spillway capacity and flood routings through the impoundment. The files did contain design inflow hydrographs.

The dam was designed to contain a storm of the magnitude of Hurricane Diane (1955), which produced 8.51 inches of rainfall in 14 hours, without discharging over the emergency spillway. Runoff for the storm would be 6.46 inches; peak discharge would be 325 cfs at Elev. 869.3.

The elevation at the top of the dam is based on either the top of the dam flood routing or the design high water flood routing plus 2 feet, whichever is higher. In this case the top of dam flood routing controls.

Design high water flood routing was based on a 15-inch rainfall in 6 hours producing 10.94 inches of runoff and a peak discharge of 6,400 cfs at Elevation 875.8.

The top of the dam flood routing was made for a rainfall of 25-inches in 6 hours, producing 16.56 inches of runoff and a peak discharge of 13,660 cfs at Elev. 878.6 (see design report in Appendix B, pages B-11 through B-15).

The figures for emergency spillway capacity given in the design report were checked and found to have been based on a Manning "n" of 0.040. This does not agree with the n = 0.035 shown on the hydrographs in the correspondence file.

In the Test Flood analysis made for this report the emergency spillway rating curve was computed using an "n" of 0.030 which was selected based on existing conditions at the time of inspection. This lower "n" value would produce higher velocities in the emergency spillway, exceeding the maximum allowable velocity at the control section of 9.02 feet per second as given in the Soil Conservation Service Design Report. The higher velocities could lead to erosion of the spillway, especially that part which is constructed on fill.

5.3 Experience Data

The impoundment has never been filled. The site is visited during periods of heavy runoff but no depth readings are taken and no records kept. The impoundment is reported to have been above the upstream berm, El. 830^{+}_{-}, on a few occasions.

5.4 Test Flood Analysis

Based on the dam failure analysis, the dam is classified as "High" hazard potential. The size of the dam is classified as "Intermediate" based on both a height of 80 feet and a maximum storage capacity of 5,000 Acre-Feet at the top of the dam. According to the Recommended Guidelines for Safety Inspection of Dams, by the Corps of Engineers, the Test Flood should be the Probable Maximum Flood (PMF). The Test Flood inflow was calculated for the 14.14 square mile watershed using 1,850 cubic feet per second per square mile (csm) from the Corps of Engineers' Guide Curve for "mountainous"

terrain. Initial water level was assumed to be at the level of the principal spillway.

The peak inflow, calculated to be about 26,000 cfs, results in a routed outflow of 16,800 cfs. The flood routing was done in accordance with the Corps of Engineers' "Estimating Effect of Surcharge Storage on Maximum Probable Discharges". The spillway capacity was calculated to be 14,800 cfs or 88 percent of the routed Test Flood outflow. The Test Flood would overtop the dam by 0.5 feet.

The above computations were made without taking into consideration the ameliorating effect of the upstream Floodwater Retarding Dam at Thousand Acre Swamp which has a watershed of 4.5 square miles. This watershed would reduce the peak inflow and most likely show the Whiting River Dam spillway capacity to be able to pass the PMF without overtopping.

5.5 Dam Failure Analysis

A dam failure analysis was made using the Corps of Engineers' "Rule of Thumb" Guidance. Failure was assumed when the water level reached the top of the dam producing a head of 80 feet.

The spillway discharge prior to dam breach was significant when compared to the dam breach flows and was taken into consideration in the flood routings. The spillway discharge was first routed through each reach assuming steady state flow. The storage volume thus obtained was subtracted from the storage required for the dam breach flood routing in order to derive the usable storage within the reach.

The calculated dam breach of 80 feet high by 100 feet wide would release up to 119,000 cfs into the Whiting River. Approximately 6,500 feet downstream of the dam an abandoned railroad embankment

is present with an assumed 100 foot long slot through it. The embankment, assuming it did not fail, would limit the downstream discharge and cause the flood waters to pond upstream, inundating 10 - 15 homes up to a depth of 20 feet. Downstream of the railroad embankment the flood waters would overtop U.S. Route 44 and flood adjacent structures to a depth of up to 7 feet. See Figure 4, page D-19.

The maximum project discharge capacity, prior to dam breach, of 14,800 cfs exceeds the capacity of the downstream culverts and would overtop the roadways up to a depth of 7 feet. The backwaters from the railroad embankment would inundate 3 - 5 homes up to a depth of 2 feet. U.S. Route 44 would be overtopped and adjoining structures would be flooded up to a depth of 2 feet.

The dam is classified as "High" hazard potential. A dam failure could result in the loss of more than a few lives and economic loss due to downstream flooding of homes.

EVALUATION OF STRUCTURAL STABILITY
SECTION 6

6.1 Visual Observations

The visual inspection did not disclose any indications of immediate structural instability. The sloping appearance of the intake structure and the reported cracks in the outlet conduit may indicate settlement of the structures. The impoundment has never been completely filled so the reaction of the structure to full hydrostatic loading is not known. The future integrity of the dam could be affected by continued erosion or settlement of the stone drains at the abutments, construction of a part of the emergency spillway on fill, and the proximity of the emergency spillway discharge to the toe of the dam.

6.2 Design and Construction Data

A design report and As-Built Plans were available for review at the Soil Conservation Service (SCS), U.S. Department of Agriculture, Storrs, Connecticut. Additional construction records were reported to be available at the Federal Archives and Record Center, Waltham, Massachusetts. The Soil Report recommended a 3:1 downstream slope and a 4:1 upstream slope. The upstream slope was selected based on computations which assumed a rapid drawdown of the impoundment. A factor of safety of 1.05 was calculated for a 3.75:1 slope. (See Appendix B, pages B-57 through B-59). Recomputation using a 4:1 slope as constructed gives a factor of safety of 1.13.

6.3 Post-Construction Changes

Settlement of the wing walls at the outlet required installation of drains behind the walls and repairs to the expansion joints in

1978. The walls appear to have been stabilized. Two cracks were noted in the outlet conduit during a 1977 inspection by the Soil Conservation Service.

6.4 Seismic Stability

The dam is located in Seismic Zone 1 and in accordance with the recommended Phase I inspection guidelines does not warrant seismic stability analysis.

ASSESSMENT, RECOMMENDATIONS, & REMEDIAL MEASURES
SECTION 7

7.1 Dam Assessment

a. Condition

On the basis of the visual inspection and a review of the available data, the dam is judged to be in good condition. The future integrity of the dam could be affected by the construction of the right side of the emergency spillway on fill, the reduced roughness coefficient of the emergency spillway, the erection of snow fence across the emergency spillway, the location of the emergency spillway discharge in relation to the dam, the continued settlement or erosion of the stone drains at the abutments, the possible settlement of the intake structure and cracking of the outlet conduit.

An evaluation of the hydraulic and hydrologic features of the dam determined that the spillways are capable of passing 88 percent of the routed Test Flood (PMF) outflow. The dam would be overtopped by about 0.5 feet. An upstream flood control dam, if considered in the computations, would reduce or eliminate the potential for overtopping.

b. Adequacy of Information

The information available was not adequate to assess the condition of the dam. As the impoundment has never been substantially filled, the behavior of the structure under full hydrostatic loading conditions is unknown.

c. Urgency

The recommendations presented in Section 7.2 and 7.3 should be carried out within two years of receipt of this Report by the owner.

7.2 Recommendations

The following recommendations should be carried out under the direction of a qualified, registered engineer:

1. The condition and potential for erosion of the right side of the emergency spillway should be investigated. Included in the investigation should be an evaluation of the design roughness coefficient compared to the existing conditions and an assessment of the permissible velocity in the spillway. The use of the emergency spillway as a softball field should be discontinued if the above investigation warrants.
2. The location of the emergency spillway discharge on a steep hillside above the toe of the dam should be evaluated and corrective action taken as required.
3. The settlement or erosion of the stone drains at the abutments should be investigated and corrective measures designed and constructed.
4. As the behavior of the dam under full hydrostatic loading is not known, the dam should be inspected by a qualified, registered engineer during each significant period of flood impoundment. Especial care should be taken in inspecting the dam whenever the previous maximum impoundment depth is exceeded.
5. The significance of the possible settlement of the intake structure and the reported cracks in the outlet conduit should be investigated and repairs made as required.

7.3 Remedial Measures

a. Operations and Maintenance Procedures

1. Flood impoundment depth readings should be taken and records kept.
2. The program of annual inspections by qualified, registered engineers should be continued.
3. The Soil Conservation Service Operations and Maintenance Handbook should be provided to the operators of the dam.
4. A downstream warning system should be developed and put into effect in case of an emergency at the dam.
5. Animal burrows should be carefully backfilled and seeded.
6. Debris should be cleaned from the intake structure and the structure checked for debris monthly.
7. The erection of the fence across the emergency spillway should not be allowed.
8. Berms should be regraded to eliminate standing water.

7.4 Alternatives

There are no practical alternatives to the above recommendations.

APPENDIX A

VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT: Whiting River Dam

DATE: 11/17/80 TIME: 11:00 am WEATHER: Sunny 35°

W.S. ELEVATION: 811.1 U.S. N/A DN.S

	PARTY	DISCIPLINE
1.	Roald Haestad, P.E. - Roald Haestad, Inc.	Civil/Geotechnical
2.	Donald L. Smith, P.E. - Roald Haestad, Inc.	Civil/Hydrologic
3.	Ronald G. Litke, P.E. - Roald Haestad, Inc.	Civil/Structural
4.		
5.		
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam Embankment	RH,DLS,RGL	Good
2.	Outlet Works - Intake Channel & Structure	RH,DLS,RGL	Good
3.	Outlet Works - Control Tower	RH,DLS,RGL	Good
4.	Outlet Works - Transition & Conduit	RH,DLS,RGL	Cracks reported in 1977
5.	Outlet Works - Outlet Structure & Channel	RH,DLS,RGL	Joint in wing wall open 1.5' at waterline
6.	Outlet Works - Emer. Spillway, Appr. & Dis. Chan.	RH,DLS,RGL	Used as ballfield; grass mowed short
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Dam Embankment NAME: RH

DISCIPLINE: Civil Engineers NAME: DLS,RGL

AREA ELEVATION	CONDITIONS
DAM EMBANKMENT	
CREST ELEVATION	878.6
CURRENT POOL ELEVATION	811.1
MAXIMUM IMPOUNDMENT TO DATE	Unknown
SURFACE CRACKS	None observed
PAVEMENT CONDITION	No pavement, crest is grass covered
MOVEMENT OR SETTLEMENT OF CREST	None observed
LATERAL MOVEMENT	None observed
VERTICAL ALIGNMENT	Good
HORIZONTAL ALIGNMENT	Good
CONDITION AT ABUTMENT AND AT CONCRETE STRUCTURES	Stone drains at abutments shown signs of settlement or erosion
INDICATIONS OF MOVEMENT OF STRUCTURAL ITEMS ON SLOPES	None observed
TRESPASSING ON SLOPES	Several minor indications of motorcycle trespass
VEGETATION ON SLOPES	Good grass cover
SLOUGHING OR EROSION OF SLOPES OR ABUTMENTS	None observed
ROCK SLOPE PROTECTION - RIPRAP FAILURES	No riprap protection except on the dike between the dam and spillway, which is in good condition.
UNUSUAL MOVEMENT OR CRACKING AT OR NEAR TOES	None observed
UNUSUAL EMBANKMENT OR DOWNSTREAM SEEPAGE	None observed; impoundment was empty
PIPING OR BOILS	N/A
FOUNDATION DRAINAGE FEATURES	Pervious drain which discharges in downstream rock fill.
TOE DRAINS	Downstream rock fill.
INSTRUMENTATION SYSTEM	None known

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Outlet Works - Intake Channel and Intake Structure NAME: RH

DISCIPLINE: Civil Engineers NAME: DLS,RGL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
A. APPROACH CHANNEL:	Under water; could not be observed
SLOPE CONDITIONS	
BOTTOM CONDITIONS	
ROCK SLIDES OR FALLS	
LOG BOOM	N/A
DEBRIS	None observed
CONDITION OF CONCRETE LINING	N/A
DRAINS OR WEEP HOLES	N/A
B. INTAKE STRUCTURE:	
CONDITION OF CONCRETE	Good
STOP LOGS AND SLOTS	Trash racks are not level

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Outlet Works - Control Tower NAME: RH

DISCIPLINE: Civil Engineers NAME: DLS,RGL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
A. CONCRETE AND STRUCTURAL:	
GENERAL CONDITION	Good; upstream end of structure appears to be lower
CONDITION OF JOINTS	Good
SPALLING	None observed
VISIBLE REINFORCING	None observed
RUSTING OR STAINING OF CONCRETE	None observed
ANY SEEPAGE OR EFFLORESCENCE	None observed (structure filled with water)
JOINT ALIGNMENT	None observed
UNUSUAL SEEPAGE OR LEAKS IN GATE CHAMBER	None observed (structure filled with water)
CRACKS	None observed
RUSTING OR CORROSION OF STEEL	None observed
B. MECHANICAL AND ELECTRICAL:	
AIR VENTS	N/A
FLOAT WELLS	N/A
CRANE HOIST	N/A
ELEVATOR	N/A
HYDRAULIC SYSTEM	N/A
SERVICE GATES	30-inch low level outlet sluice gate reported operable
EMERGENCY GATES	N/A
LIGHTNING PROTECTION SYSTEM	N/A
EMERGENCY POWER SYSTEM	N/A
WIRING AND LIGHTING SYSTEM IN GATE CHAMBER	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Outlet Works - Transition and Conduit NAME: RH

DISCIPLINE: Civil Engineers NAME: DLS,RGL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - TRANSITION AND CONDUIT	3.5' x 3.5' Monolithic Concrete Conduit
GENERAL CONDITION OF CONCRETE	Could not be observed
RUST OR STAINING ON CONCRETE	
SPALLING	
EROSION OR CAVITATION	
CRACKING	
ALIGNMENT OF MONOLITHS	
ALIGNMENT OF JOINTS	
NUMBERING OF MONOLITHS	

OTHER: 1977 Inspection Report noted two (2) cracks observed in conduit.

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Outlet Works - Outlet Structure & Outlet Channel NAME: RH

DISCIPLINE: Civil Engineer NAME: DLS,RGL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
GENERAL CONDITION OF CONCRETE	Good
RUST OR STAINING	None observed
SPALLING	None observed
EROSION OR CAVITATION	None observed
VISIBLE REINFORCING	None observed
ANY SEEPAGE OR EFFLORESCENCE	None observed
CONDITION AT JOINTS	Joint at right wingwall open 1.5' at waterline
DRAIN HOLES	N/A
CHANNEL	Widened natural channel of Whiting River
LOOSE ROCK OR TREES OVERHANGING CHANNEL	Some trees 200' downstream
CONDITION OF DISCHARGE CHANNEL	Good

PERIODIC INSPECTION CHECK LIST

PROJECT: Whiting River Dam DATE: 11/17/80

PROJECT FEATURE: Outlet Works - Emer. Spillway, Appr. & Dishcarge Channel NAME: RH

DISCIPLINE: Civil Engineers NAME: DLS,RGL

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
A. APPROACH CHANNEL:	Good
GENERAL CONDITION:	Good
LOOSE ROCK OVERHANGING CHANNEL	None observed
TREES OVERHANGING CHANNEL	None observed
FLOOR OF APPROACH CHANNEL	Grassed
B. EMERGENCY SPILLWAY:	
GENERAL CONDITION	Good
SURFACE	Grassed surface mowed short for ballfield at control section
DIKE	Riprap slope on spillway side; grassed slope on dam side
OTHER	Rolled up snow fence observed; reported to be home run fence for ballfield
C. DISCHARGE CHANNEL:	
GENERAL CONDITION	Good; discharges to river downstream of toe
LOOSE ROCK OVERHANGING CHANNEL	None observed
TREES OVERHANGING CHANNEL	None observed
FLOOR OF CHANNEL	Grassed
OTHER OBSTRUCTIONS	

APPENDIX B

ENGINEERING DATA

LIST OF REFERENCES

Reference Nos. 1 and 2 are available at the State of Connecticut Department of Environmental Protection, Water and Related Resources Section, State Office Building, Hartford, Connecticut. Reference Nos. 3 through 6 are available from the Soil Conservation Service of the U.S. Department of Agriculture, Mansfield Professional Park, Route 44-A, Storrs, Connecticut. Reference No. 7 is located at the Federal Archives and Record Center, Waltham, Massachusetts.

1. Correspondence file on the Blackberry River Watershed Project, Floodwater Retarding Dam No. 15, North Canaan, Connecticut.

2. "Reservoir Operation Data" and "Pertinent Data" prepared by Anderson - Nichols Associates, February 1967.

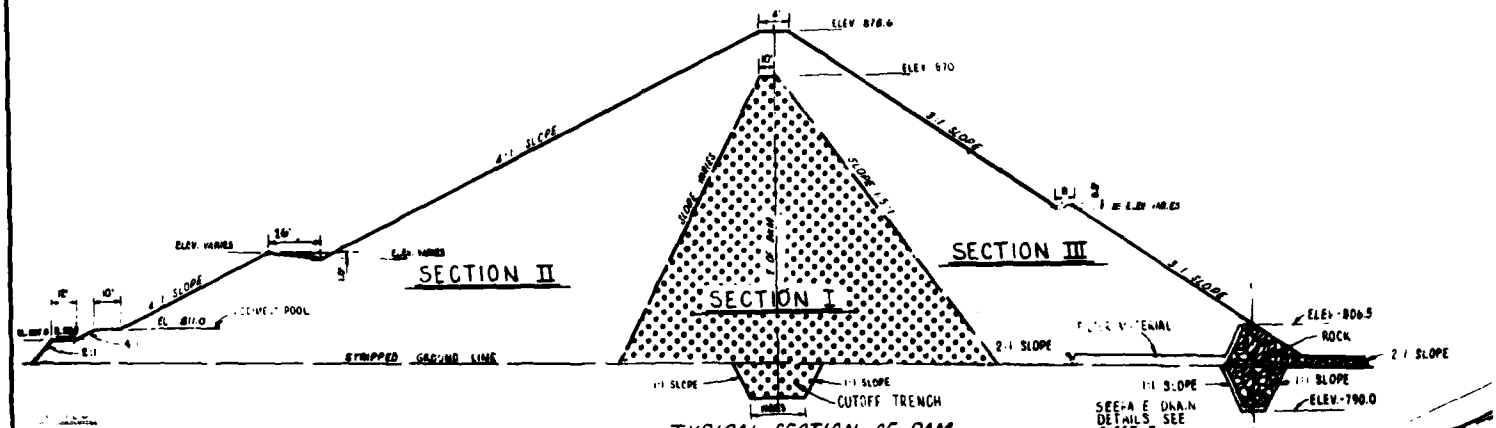
3. Design Report, Blackberry River Watershed Site No. 15, North Canaan, Connecticut.

4. Plans for Blackberry River Watershed Project, Floodwater Retarding Site No. 15, North Canaan, Connecticut, October 1962.

5. "As-Built" Plans for Blackberry River Watershed Project, Floodwater Retarding Site No. 15, North Canaan, Connecticut, 1968.

6. Construction progress photographs.

7. Soil Test Results, Change Orders and miscellaneous data.

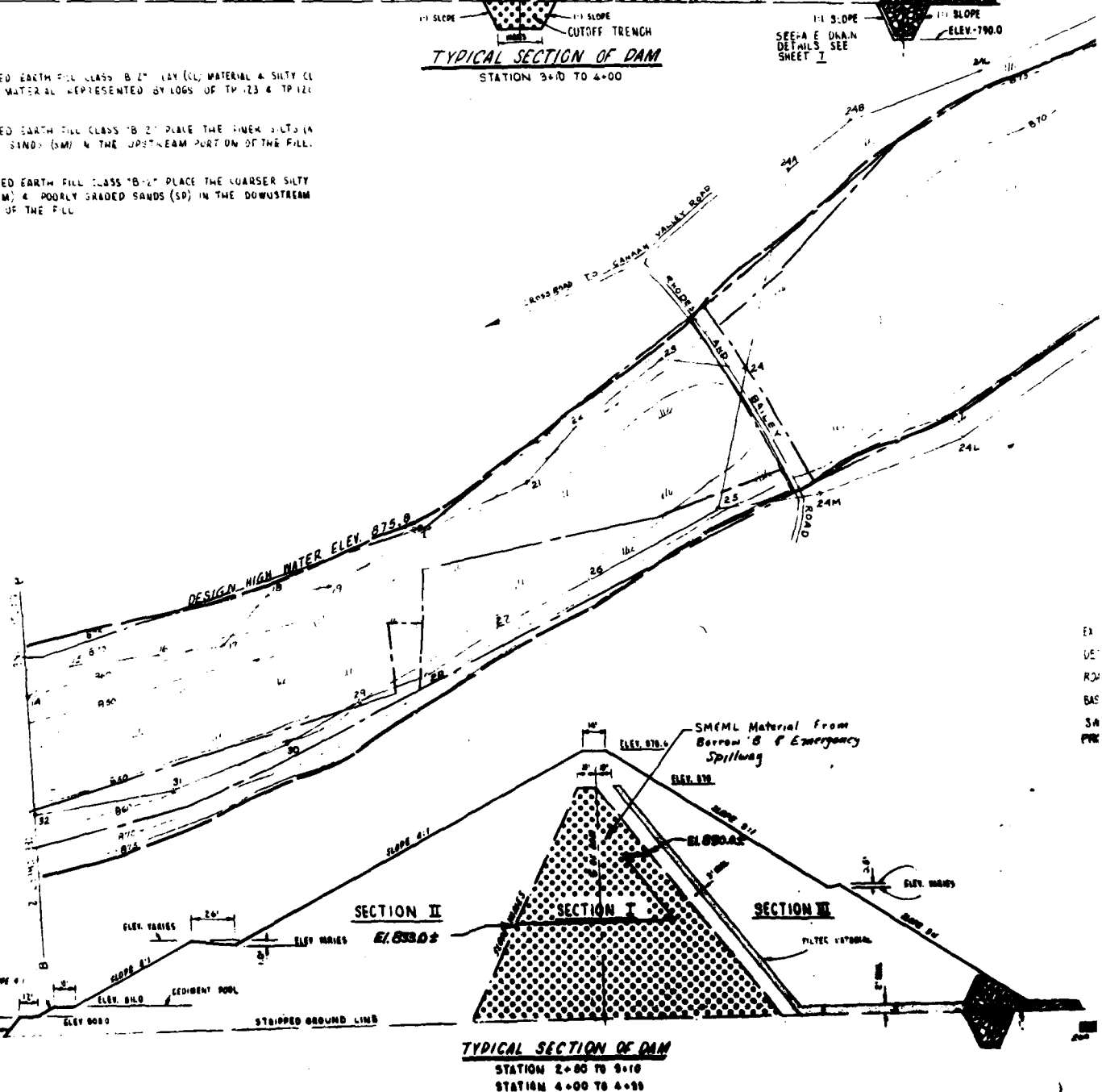


TYPICAL SECTION OF DAM
STATION 3+10 TO 4+00

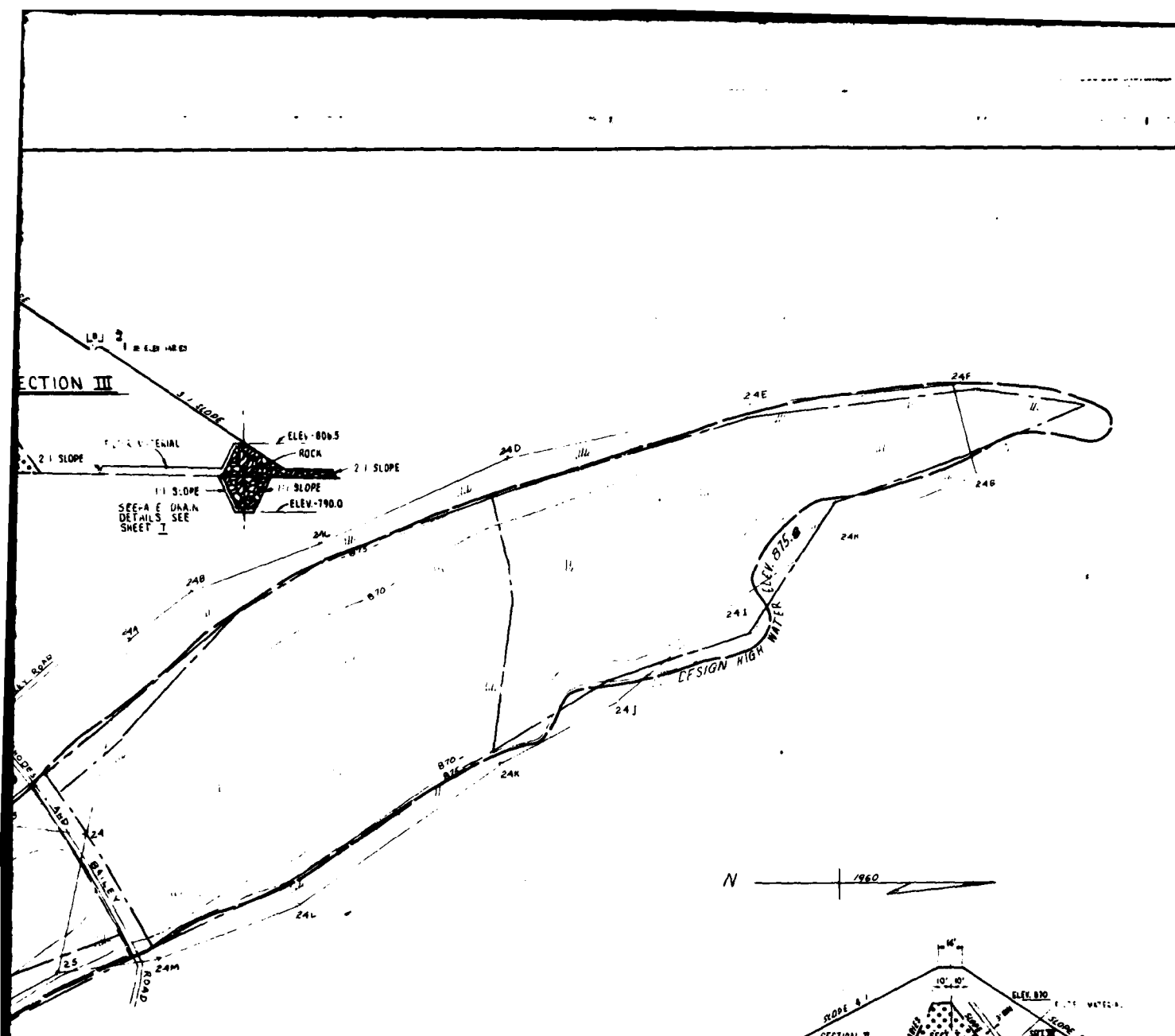
SECTION I
COMPACTED EARTH FILL CLASS B 2" LAY (CL) MATERIAL & SILTY CL (CL ML) MATERIAL REPRESENTED BY LOGS OF TP 123 & TP 120

SECTION II
COMPACTED EARTH FILL CLASS "B 2" PLACE THE FINER SILTS (M & SILTY SANDS (SM) IN THE UPSTREAM PORTION OF THE FILL.

SECTION III
COMPACTED EARTH FILL CLASS "B-2" PLACE THE COARSER SILTY SANDS (SM) & POORLY GRADED SANDS (SP) IN THE DOWNSTREAM PORTION OF THE FILL



TYPICAL SECTION OF DAM
STATION 2+80 TO 3+10
STATION 4+00 TO 4+30

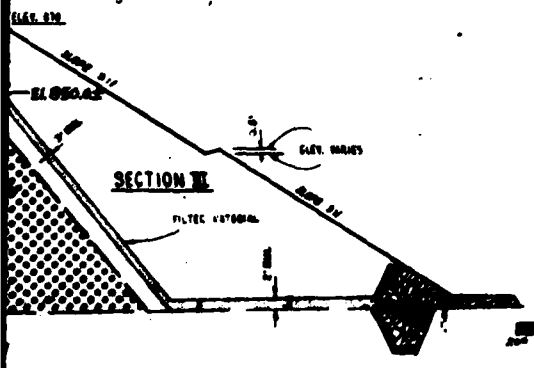


TYPICAL SECTION OF DAM
STATION 1+80 TO 2+50
STATION 4+35 TO 5+50

LEGEND

EXISTING GROUND CONTOURS
DESIGN HIGH WATER
ROADS
BASE LINE
SWAMP
PROPERTY & EASEMENT LINE

SMEML Material From Borrow 'B' & Emergency Spillway



CONTOUR INTERVAL 10 FT.

SCALE

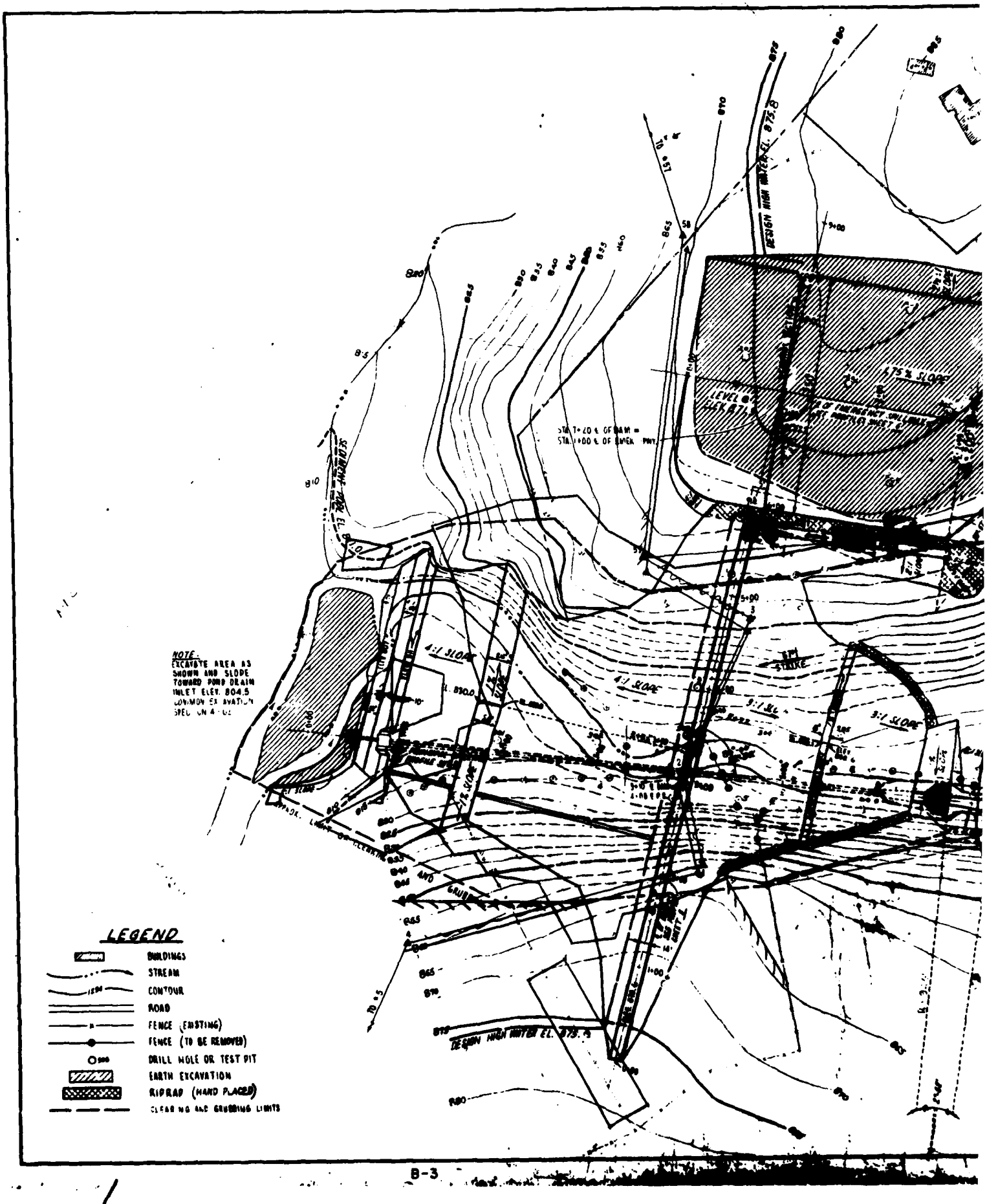
AS-BUILT

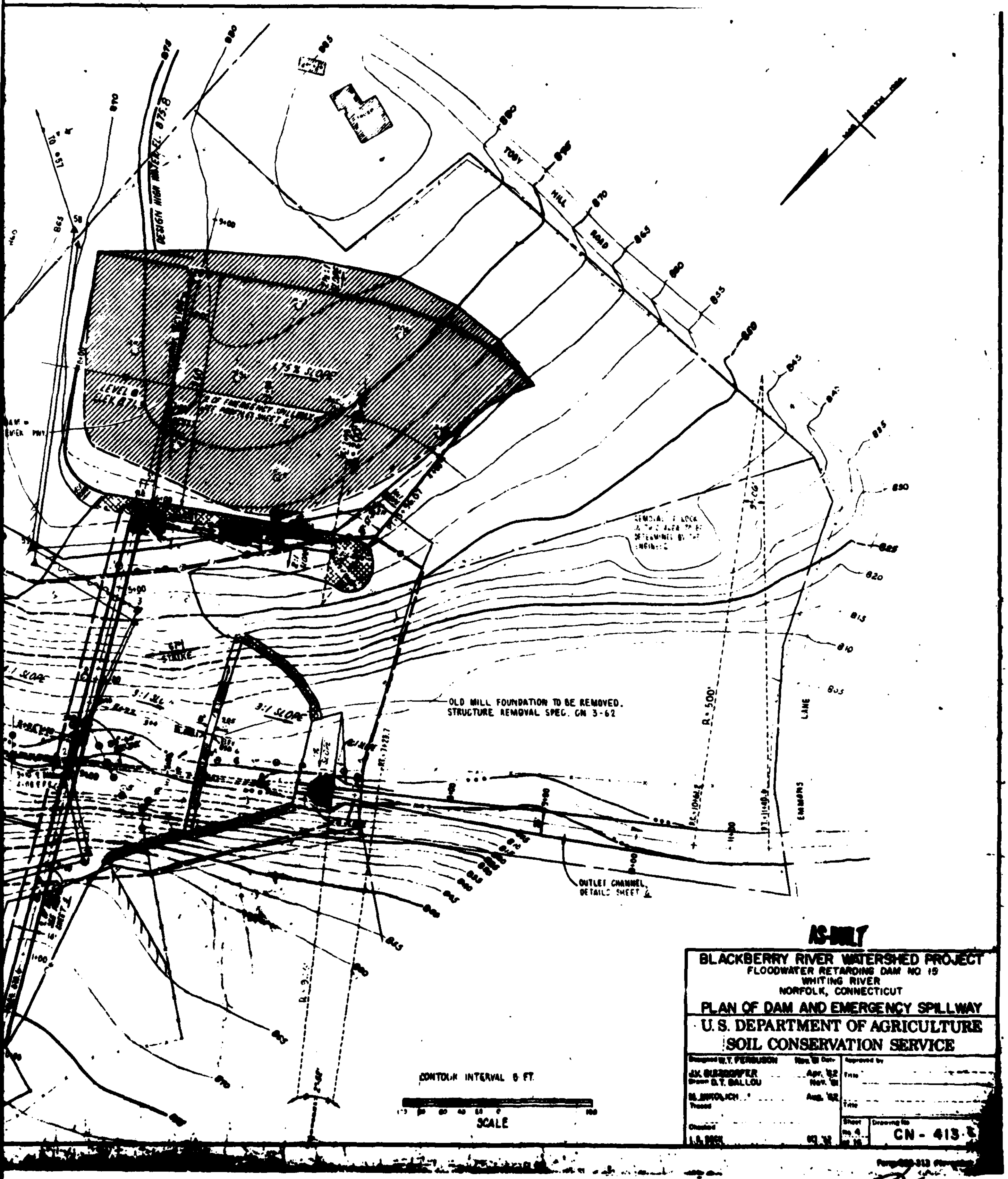
BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 15
WHITING RIVER
NORFOLK, CONNECTICUT

PLAN OF STORAGE AREAS - NORTH END

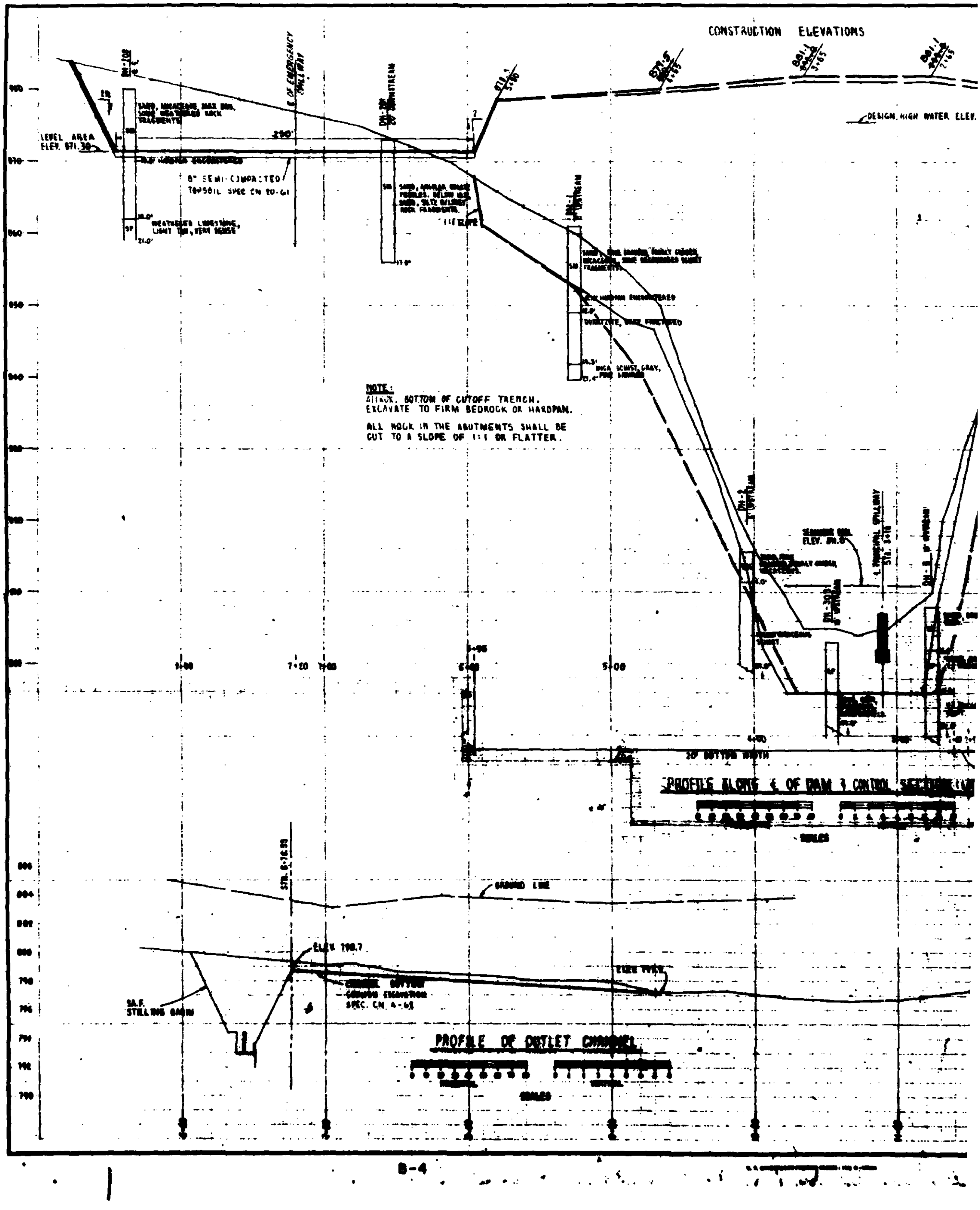
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed W.T FERGUSON	Nov. '61	Approved by	
J.V. BISZOPPER	Apr. '62	Title	
Drawn D.T. BALLOU	Nov. '61		
M. MIKOLICH	Aug. '62	Title	
Traced			
Checked		Sheet No. 3	Drawing No. CN - 413 -
L.S. BECK	9/1/62		

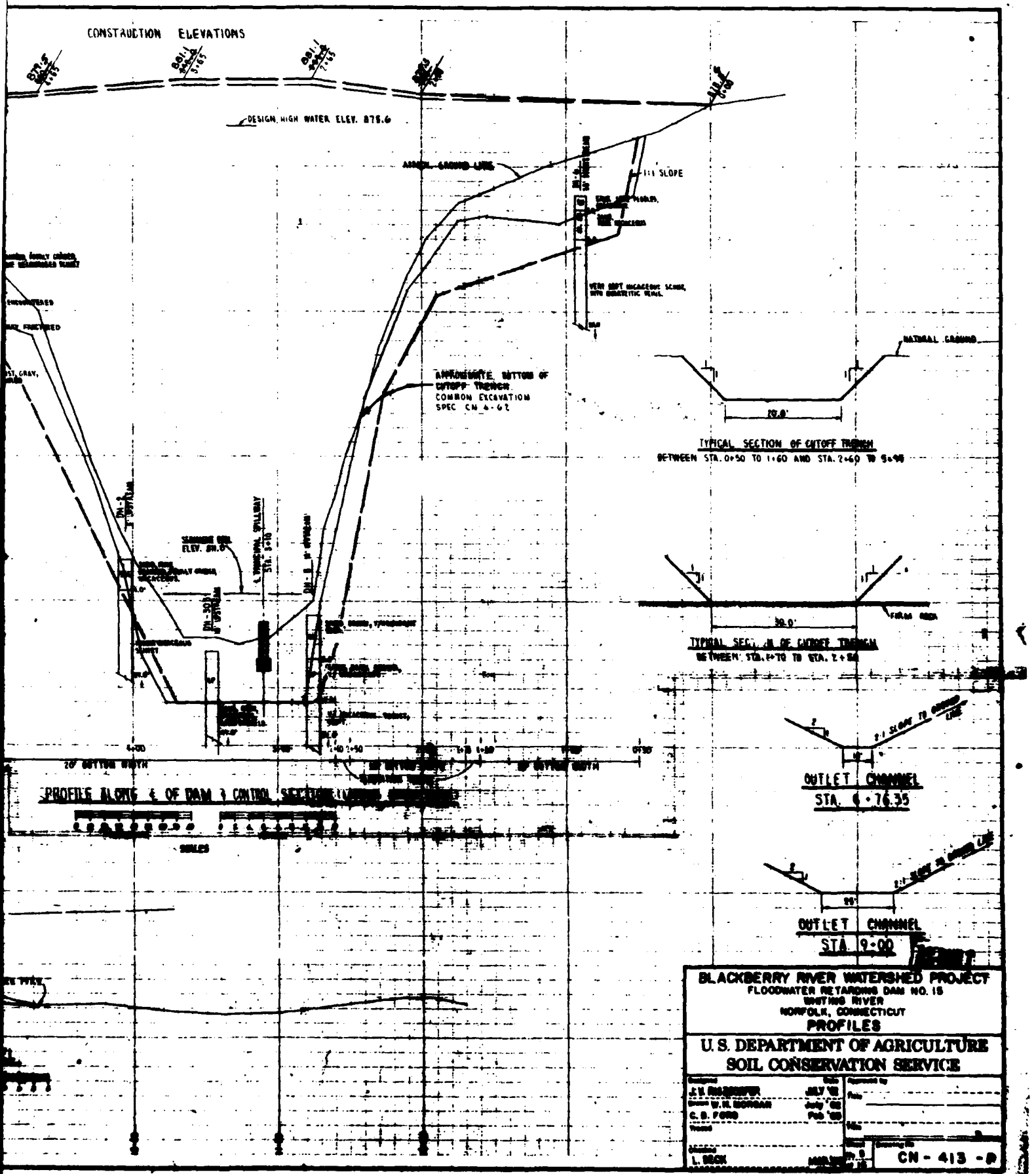

NOTE:
EXCAVATE AREA AS SHOWN AND SLOPE TOWARD POND DRAIN INLET ELEV. 804.5
LEGEND
BUILDINGS
STREAM
CONTOUR
ROAD
FENCE (EXISTING)
FENCE (TO BE REMOVED)
DRILL HOLE OR TEST PIT
EARTH EXCAVATION
RIPRAP (HAND PLACED)
CLEARING AND GRUBBING LIMITS
DESIGN HIGH WATER EL. 875.8
DESIGN HIGH WATER EL. 875.8
4:1 SLOPE
3:1 SLOPE
2:1 SLOPE
4.75% SLOPE



TOBY MILL ROAD
DESIGN HIGH WATER EL. 875.8
1.75% SLOPE
OLD MILL FOUNDATION TO BE REMOVED.
STRUCTURE REMOVAL SPEC. CN 3-62
3:1 SLOPE
R = 500'
LANE
OUTLET CHANNEL
DETAILS SHEET 6
CONTOUR INTERVAL 5 FT.
SCALE
AS-BUILT
BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO 15
WHITING RIVER
NORFOLK, CONNECTICUT
PLAN OF DAM AND EMERGENCY SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
W.T. FERGUSON
D.T. BALLOU
CN - 413


CONSTRUCTION ELEVATIONS
DESIGN HIGH WATER ELEV.
LEVEL AREA
ELEV. 971.30
8" SEMI-COMPACTED
TOPSOIL SPEC CN 20-61
WEATHERED LIMESTONE,
LIGHT TAN, VERY DENSE
QUARTZITE, SOME FRACTURED
MICA SCHIST, GRAY,
NOTE:
APPROX. BOTTOM OF CUTOFF TRENCH.
EXCAVATE TO FIRM BEDROCK OR HARDPAN.
ALL ROCK IN THE ABUTMENTS SHALL BE
CUT TO A SLOPE OF 1:1 OR FLATTER.
7+20
6+00
5+00
4+00
20' BOTTOM WIDTH
SCALES
GROUND LINE
ELEV. 798.7
CHANNEL BOTTOM
SPEC. CN. 4-61
SAF
STILLING BASIN
PROFILE OF OUTLET CHANNEL
SCALES

CONSTRUCTION ELEVATIONS



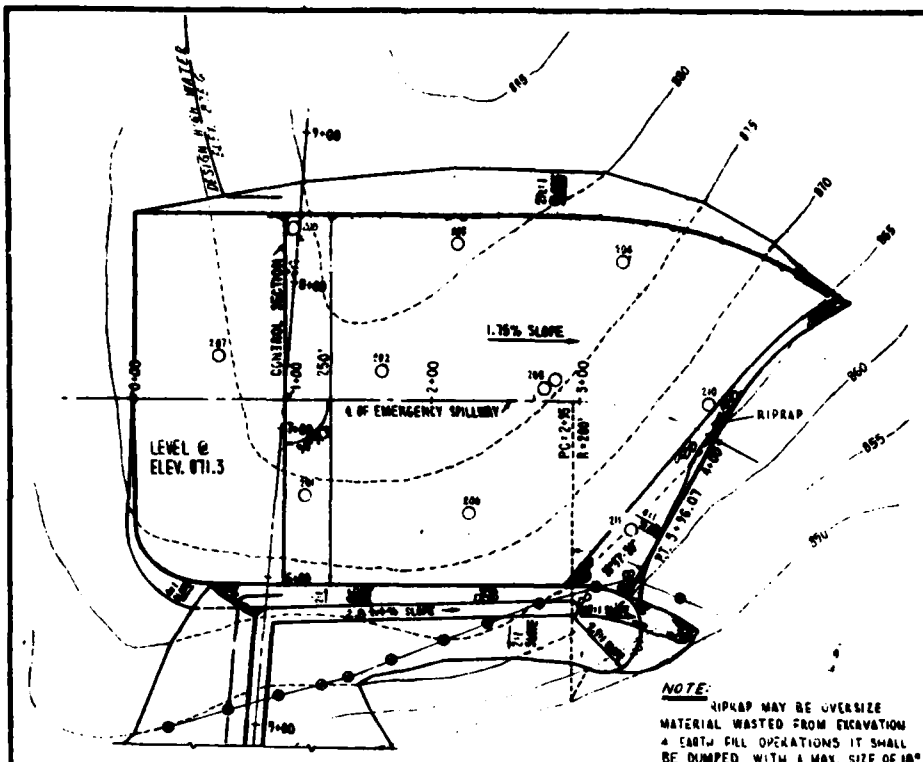
BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 15
WATINS RIVER
NORFOLK, CONNECTICUT
PROFILES

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	J.H. RADDEMEYER	JULY '62
Drawn	W.R. DORGAN	July '62
Checked	C.B. FORD	Feb '63
Traced		
Checked	L. BECK	

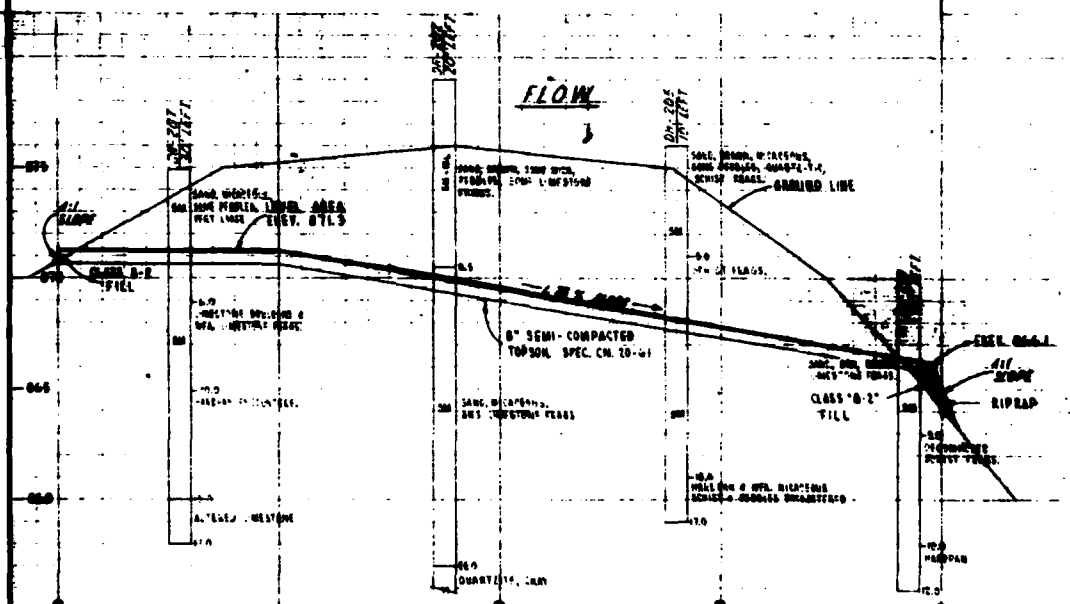
Approved by
Date
Title
Sheet No. 5 of 10 Sheets
CN - 413 - D

2



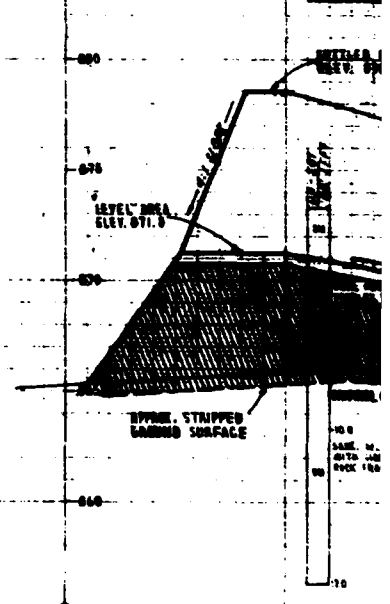
PLAN OF EMERGENCY SPILLWAY

SCALE : 1" = 60.0'

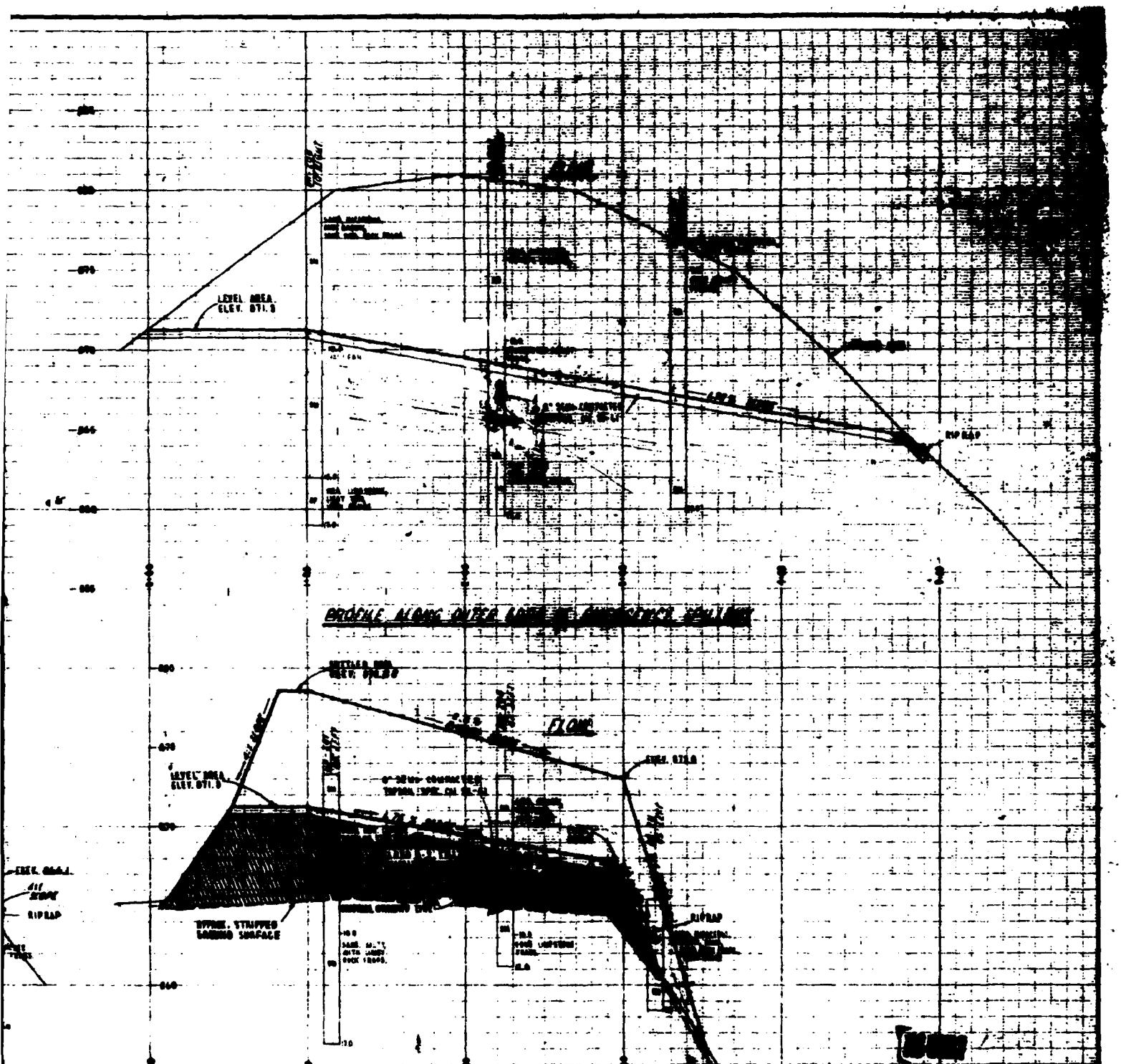


PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

TYPICAL SECTION OF EMERGENCY SPILLWAY



PROFILE ALONG INL



PROFILE ALONG OUTER EDGE OF EMERGENCY SPILLWAY

PROFILE ALONG INNER EDGE OF EMERGENCY SPILLWAY

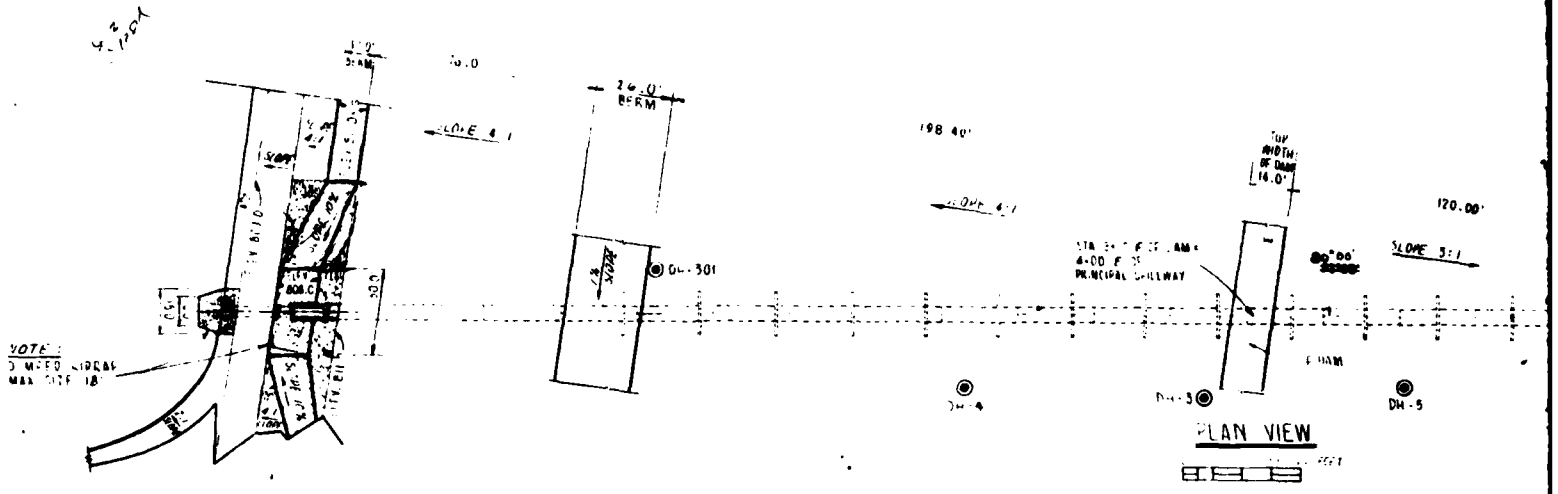
BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 15
WHITING RIVER
NORFOLK, CONNECTICUT

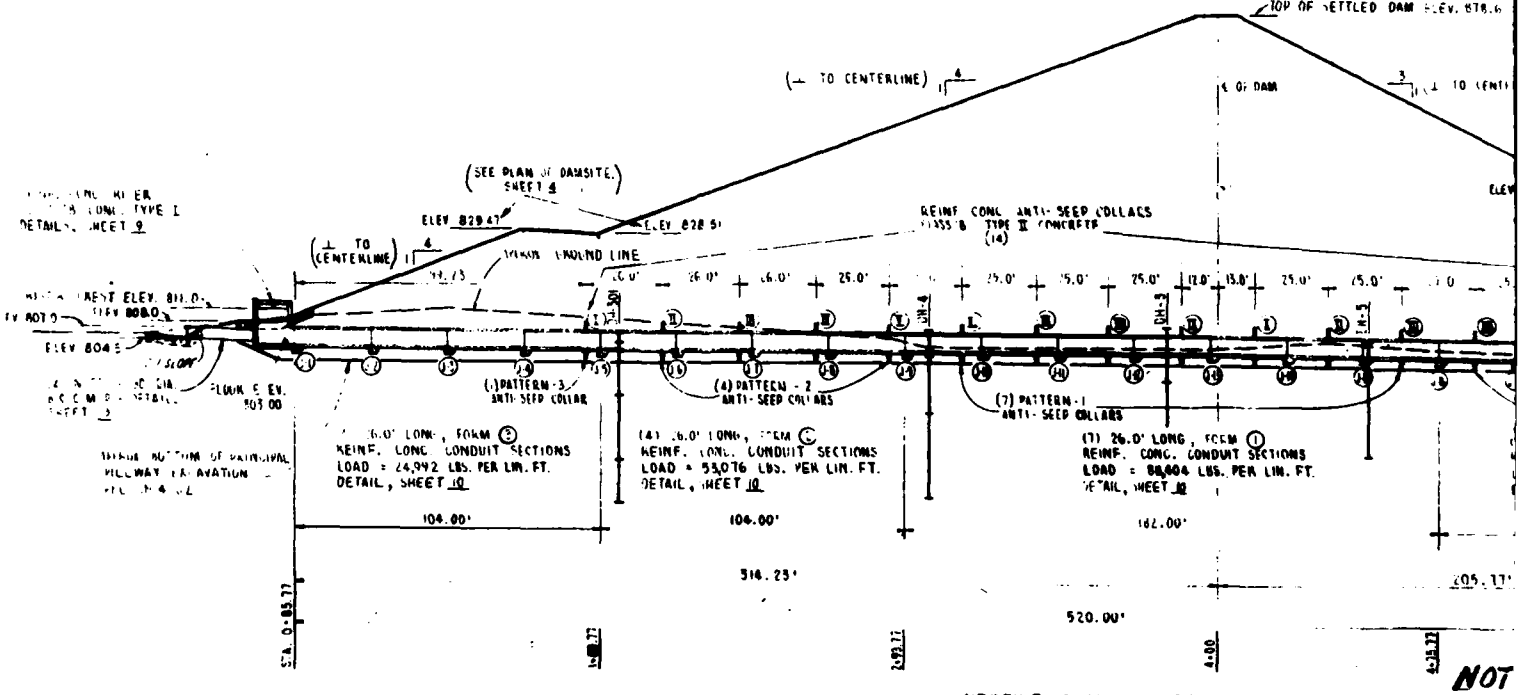
EMERGENCY SPILLWAY DETAILS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ... Date ...
Drawn ... Date ...
Traced ... Date ...
Checked ... Date ...
Approved by ... Title ... Date ...
Sheet No. 2 | Drawing No. CN - 413 - P

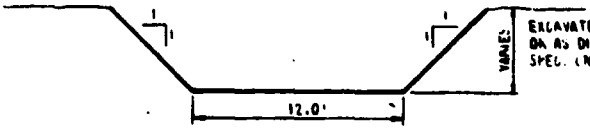
2





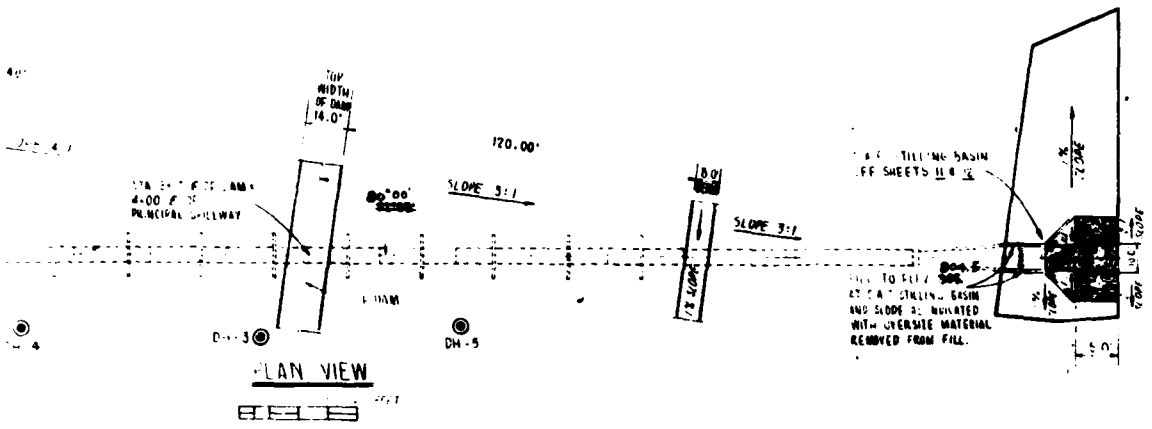
PROFILE ALONG ℄ PRINCIPAL SPILLWAY

SCALE: HOR. VERT. 0 10 20 30 FEET

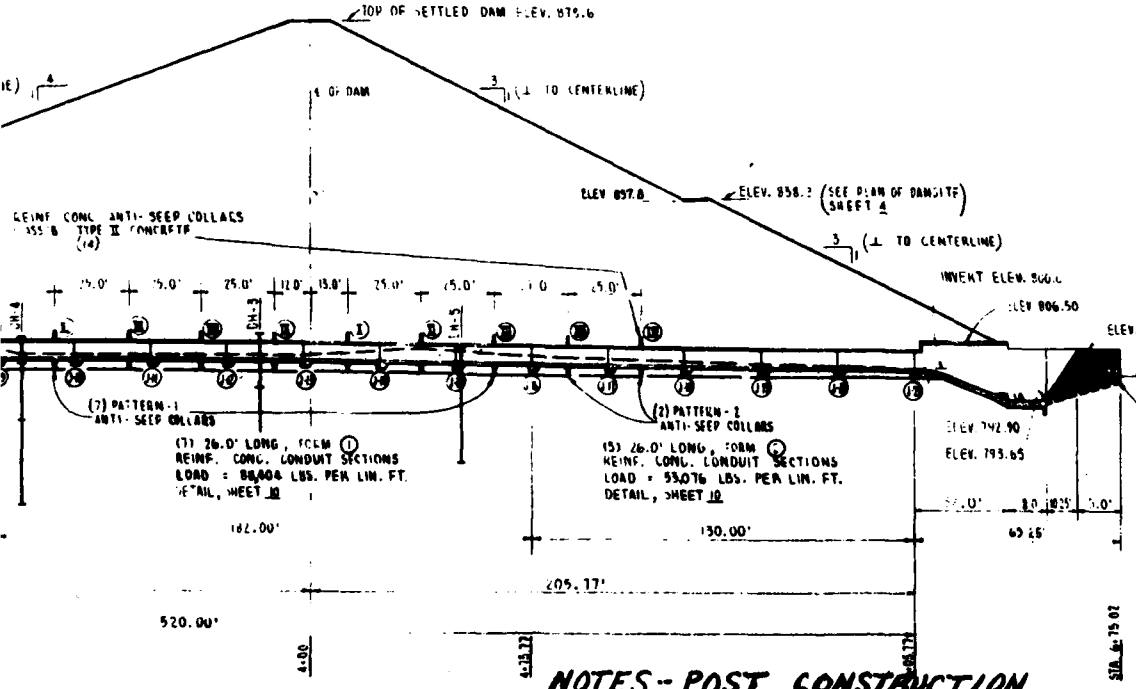


TYPICAL SECTION OF PRINCIPAL SPILLWAY EXCAVATION

NOT TO SCALE



AS BUILT INVERT ELEV.	JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF CONDUIT	SLOPE
802.91	J-1	0	803.00	S = 0.00322
802.91		26	802.92	
802.79	J-3	52	802.85	
802.71	J-4	78	802.75	
802.61	J-5	104	802.67	
802.58	J-6	130	802.58	
802.45	J-7	156	802.50	
802.34	J-8	182	802.42	
802.26	J-9	208	802.33	
802.25	J-10	234	802.25	
802.19	J-11	260	802.17	
802.12	J-12	286	802.08	
802.00	J-13	312	802.00	
801.76	J-14	338	801.75	S = 0.00964
801.50	J-15	364	801.50	
801.38	J-16	390	801.25	
800.97	J-17	416	801.00	
800.74	J-18	442	800.75	
800.47	J-19	468	800.50	
800.20	J-20	494	800.25	
799.98	J-21	520	800.00	



PROFILE ALONG ℄ PRINCIPAL SPILLWAY

SCALE: HOR. VERT 0 10 20 30 FEET

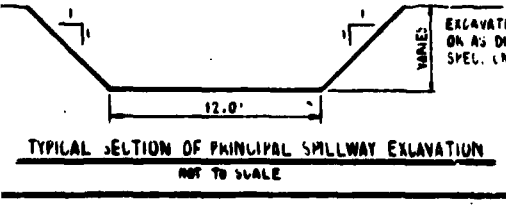
COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV OF CONDUIT
I	49.23	802.68
II	125.23	802.60
III	151.23	802.51
IV	177.23	802.43
V	202.23	802.35
VI	227.23	802.27
VII	252.23	802.19
VIII	277.23	802.11
IX	302.23	802.03
X	327.23	801.85
XI	352.23	801.61
XII	377.23	801.37
XIII	402.23	801.13
XIV	427.23	800.89

NOTE

ABOVE DIMENSIONS FOR LENGTHS OF CONDUIT ARE NOMINAL AND DO NOT INCLUDE CREEP

NOTES - POST CONSTRUCTION

7/77 CONCRETE CRACKS 13.2' D.S. FROM J-15 AND 14'-16' D.S. FROM J-16



TYPICAL SECTION OF PRINCIPAL SPILLWAY EXCAVATION

NOT TO SCALE

AS-BUILT

BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 15
WHITING RIVER
NORFOLK, CONNECTICUT

PLAN-PROFILE OF PRINCIPAL SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

W.T. FERGUSON — Designed
J.V. RISZDORFER — Drawn — Apr. '68
W.H. MORGAN — Traced
Approved by
Date
Sheet No. 8 of 10 Sheets
CN - 413 -P

Form SCS-313 (Revised 1968)

UNITED STATES GOVERNMENT

Memorandum

TO : T. R. Wire, State Conservation Engineer, SCS, Storrs, Connecticut

DATE: April 23, 1963

FROM : W. T. Ferguson, Jr., Civil Engineer, SCS, Storrs, Connecticut

SUBJECT: ENGINEERING - Blackberry River Watershed, Site No. 15

To refer to a memo from E&WP Unit dated March 22, 1963 regarding a suggested revision of the toe drain design, I've studied this for a while and have finally arrived at some conclusions of my own, valid or otherwise.

In general, I think Stan Rossier is right, that the 15 foot vertical drain as recommended by the lab might not adequately control the hydraulic gradient, but I think the main point is really the difficulty of construction. The conditions are very similar to the Whitney Site, although perhaps there aren't as many large boulders, and there is apparently more water in the sands and gravels of this foundation than there were in the pre-loaded till at Whitney. I believe that the question of this vertical drain being adequate is minimized by the fact that it would probably be impossible to excavate a 15' deep 3' wide trench in this material, and we would end up with a wide, trapezoidal trench anyway.

Therefore, I think that it is more a question of the most effective drain and a practical location of it from the construction angle, because the typical section would probably be dictated by the manner in which this material could be efficiently removed.

As mentioned before, I think Rossier's proposal is right, but I also think that the drain could be made shallower at the conduit and total quantities reduced from Stan's proposed Scheme B to something nearer the original Scheme A.

I have plotted the graphical logs of the borings through the embankment to show the blow-count and also to indicate the zone which, if any, would appear to be slightly more permeable, although there doesn't seem to be any clearcut stratification. Noting that the most well-defined zone of low blow-count water-bearing material occurs over the rock peak, it suggests that this is the result of the constriction in the valley section. Then downstream, there is no longer any clearly defined loose layer, with the gradation running over a range of sands to gravels and boulders. The boring logs seem to me to indicate fairly sound material, with the water content contributing to a somewhat lower blow-count than might normally be expected in such material, but the consolidation potential seems low.

It also seems significant that at Hole 305 the dominating feature seems to be the coarser gradation from well graded sands and gravels to a layer of boulders, starting virtually from the ground surface.

As the foundation permeability is estimated and couldn't really be determined accurately without an elaborate pattern of on-site permeability tests, the actual volume of flow to be handled by the toe drain is unknown, but this is a pretty standard situation.

What this all boils down to is that I think it would be reasonable to use the trapezoidal rock toe section with filter layer, but only cut it to elev. 796 as originally proposed with an 8' bottom width, which would bring it down to the gravel and bouldery zone. At best, it may be a mean job to excavate, dewater, and place filter materials in such a narrow valley section and still have it come out right, and I would think that the rock toe similar to the Whitney job should be able to handle a very high volume of flow and remain stable.

spike

T. A. Wilson

COMPUTATION SHEET
SCS-523 REV 5-58

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Connecticut PROJECT Blackberry River Site 15
BY SCR DATE 9/13/63 CHECKED BY DATE JOB NO CN-413-P
SUBJECT WORK PLAN - DESIGN COMPARISON SHEET SHEET 1 OF 2

ITEM	UNIT	WORK PLAN	DESIGN	COMMENTS
DRAINAGE AREA	SQ MILE	9.65	9.65	
STORAGE CAPACITY				
SEDIMENT (INCL FLOOD SED.)	ACRE-FEET	36.3	29.5	
FISH & WILDLIFE OR MISC.	ACRE-FEET			
FLOODWATER	ACRE-FEET	3,325.0	3,570	
TOTAL	ACRE-FEET	3,360.3	3,600	
BETWEEN HIGH & LOW STAGE	ACRE-FEET			
SURFACE AREA				
NORMAL POOL	ACRE	7.8	4.7	
FLOODWATER POOL	ACRE	156.0	151.0	
DESIGN HIGH WATER	ACRE		193.0	
VOLUME OF FILL	CUBIC YARD	100,000	178,500	
ELEVATION TOP OF DAM	FEET		878.6	
MAXIMUM HEIGHT OF DAM	FEET	74.5	77	
EMERGENCY SPILLWAY				
CREST ELEVATION	FEET		871.3	
BOTTOM WIDTH	FEET	257.0	250.0	
TYPE		Veg	Veg	
PERCENT CHANCE OF USE		1	< 1 *	* crest set by Routing Hurricane Diane
AVE. CURVE NO. COND. II				
EMERGENCY SPILLWAY HYDROGRAPH				
STORM RAINFALL - 6 HOUR	INCH	21.7		
STORM RUNOFF	INCH			
VELOCITY OF FLOW - Vc	FT PER SECOND			
PEAK DISCHARGE RATE	CUBIC FT PER SEC	238	325 *	* Hurricane Diane
MAXIMUM WATER SURFACE ELEV	FEET			
FREEBOARD HYDROGRAPH				
STORM RAINFALL - 6 HOUR	INCH			
STORM RUNOFF	INCH			
VELOCITY OF FLOW - Vc	FT PER SECOND		9	
PEAK DISCHARGE RATE	CUBIC FT PER SEC	15,200	13,660 *	2.5 x 6 hr pt Rainfall Moist Cond II.
MAXIMUM WATER SURFACE ELEV	FEET			

COMPUTATION SHEET
SCS-523 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O - 470861

STATE Connecticut | PROJECT Blackberry River Site 15
BY SCR | DATE 9/13/63 | CHECKED BY | DATE | JOB NO. CN-413-P
SUBJECT WORK PLAN - DESIGN COMPARISON SHEET | SHEET 2 OF 2

ITEM	UNIT	WORK PLAN	DESIGN	COMMENTS
PRINCIPAL SPILLWAY - RISER SIZE	INSIDE DIMEN. (FT)		3.5' x 10.5'	
LOW STAGE	CUBIC FT PER SEC	238	323.4*	* Reqd Time Empty 10 days
ORIFICE SIZE	OPENING - FT		29.3'	Weir single stage
~~HIGH STAGE~~	CUBIC FT PER SEC			
PIPE SIZE	INSIDE DIAMETER		3.5' x 3.5'	Monolithic conduit
CAPACITY EQUIVALENTS				
SEDIMENT VOLUME INCL FLOOD SEDIMENT	INCH	0.07	0.057	
DETENTION VOLUME - FLOODWATER	INCH	6.5	6.94	
SPILLWAY STORAGE - TO TOP OF DAM	INCH	2.5	0.06 *	Elev of Sply. has been arbitrarily raised
CLASS - STRUCTURE		C	C	
CONSTRUCTION COSTS - INCL CONTINGENCIES		$140,000		
B/C RATIO				

DESIGN REPORT

BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 15
LITCHFIELD COUNTY, CONNECTICUT

This floodwater retarding dam is located approximately 4.6 miles northwest of Norfolk, Connecticut, on the Whiting River which is a tributary of the Blackberry River. The transparent overlay on sheet 4 of this report, together with the Ashly Falls, Massachusetts and Connecticut 7'30" quadrangle published by the U.S. Geological Survey may be used to locate the structure.

This dam is a class (c) structure (Engineering Memorandum SCS-27) and is designed in accordance with criteria established by the Soil Conservation Service.

This structure is one of five which will provide flood protection for the Blackberry River flood plain. It is designed to handle the hurricane "Diane" without emergency spillway flow.

This structure is designed as a compacted earth fill on a pervious foundation with a drainage system under the downstream portion of the embankment to control the effects of seepage. The principal spillway will consist of an octagonal monolithic reinforced concrete conduit with a reinforced concrete riser. The riser will be equipped with a slide gate to permit drainage of the sediment pool. The conduit will outlet through a flared concrete transition channel and a SAF energy dissipator. The emergency spillway will be an earth cut through silty sand in the south abutment of the dam and will have a vegetative cover.

The results of hydrologic and hydraulic determinations are given in the following table:

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. CN-413-R SHEET 1 OF 5 DATE 5/29/63

DESIGN REPORT

Factor Which Determines Stage	Surface Area Acres	Runoff in Inches	Peak Inflow c.f.s.	Peak Outflow c.f.s.	Elev. of Maximum Stage	Storage in Ac.-Ft.	Element of Structure Determined by Maximum Stage
50-year sediment accumulation	4.7	-	-	-	811.0	26.6	Crest of riser
Routing[1] hurricane "Diane"	151	6.46	6,345	325	869.3[2]	3260	Crest of emergency spillway
Routing 15" point rainfall during 6 hours	193	10.94[1]	13,700	6400	875.8	3950	Design high water
Routing 2.5x6-hr.[1][3] point rainfall using moisture condition II	215	16.56	20,680	13,660	878.6	4526	Top of dam

1/ Neglects the discharge from site 1.

2/ The crest of the emergency spillway is set at elevation 871.3 because of the limitation of the permissible velocity to approximately 9 feet per second.

3/ Routing is from elevation 837.35 established by 7.5 days of drawdown from the "Diane" storm crest elevation of 869.30.

The time to empty 100 percent of the flood storage is 10.2 days.

Copies of the geology and soil mechanics laboratory reports used in the design of this structure are attached.

The following publications were used in the design of this dam:

National Engineering Handbook No. 5, Hydraulics
National Engineering Handbook No. 4, Hydrology
National Engineering Handbook No. 6, Structural Design
Engineering Division Technical Releases Nos. 2, 5 and 10

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. CN-413-R SHEET 2 OF 5 DATE 5/29/63

DESIGN REPORT

Copies of these publications may be obtained from Mr. H. Paul Tedrow State Conservationist, USDA, Soil Conservation Service, Storrs Connecticut .

Concurred:

Gerald E. Oman
Design Engineer

T. R. Wire
State Conservation Engineer

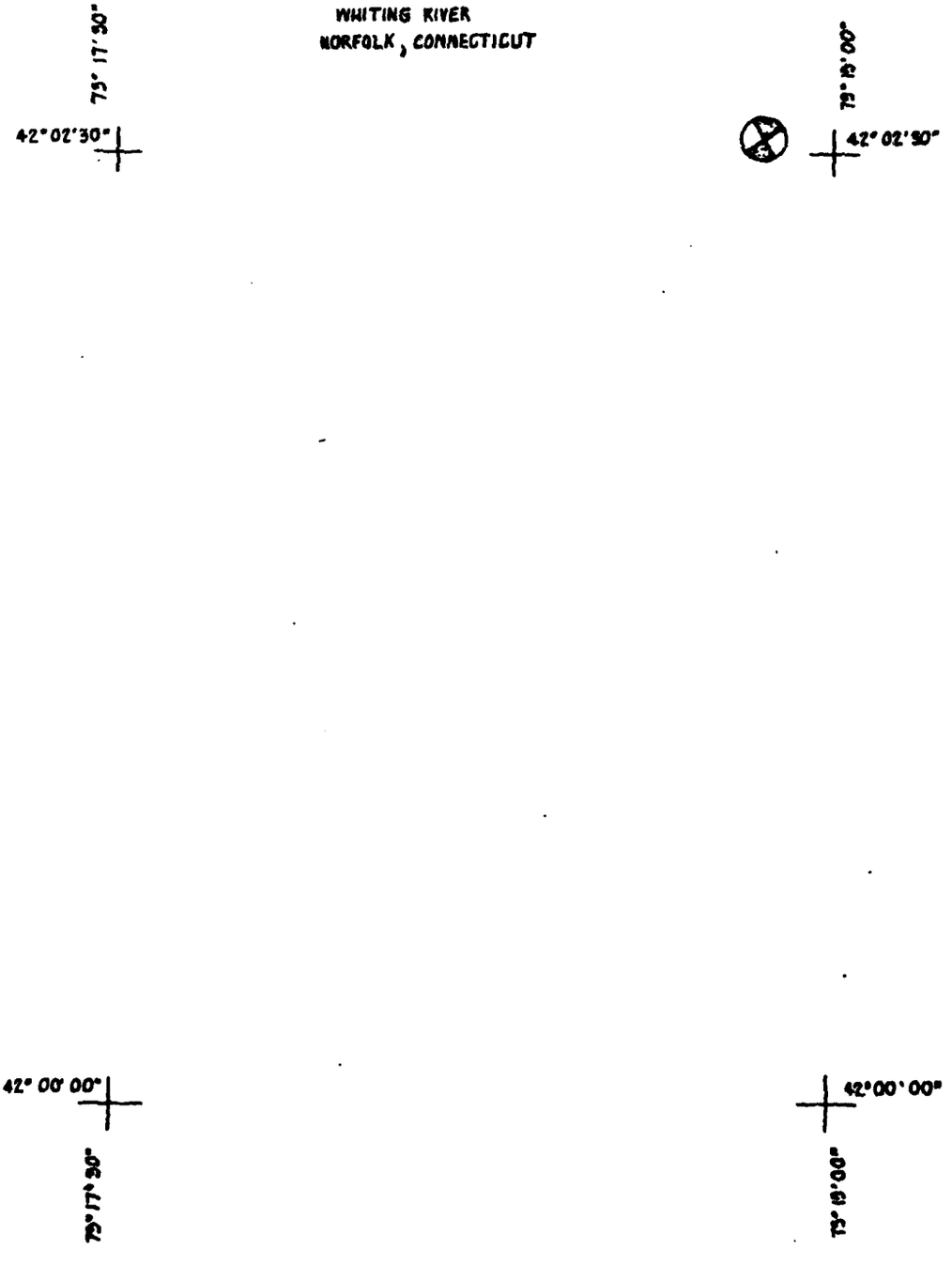
Vincent McKeever
Hydrologist

Robert F. Fonner
Geologist

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. CN-413-R SHEET 3 OF 3 DATE 3/29/63

DESIGN REPORT

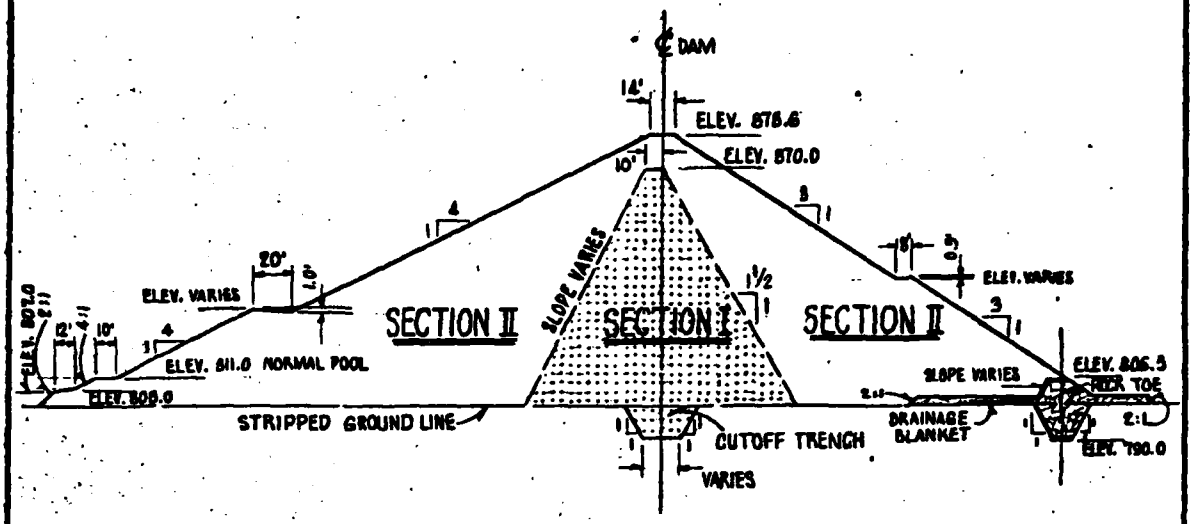
BLACKBERRY RIVER WATERSHED PROJECT
FLOODWATER RETARDING DAM 15
WHITING RIVER
NORFOLK, CONNECTICUT



REFERENCE:		
ASHLEY FALLS, MASS.-CONN. 7' 30" QUADRANGLE	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. CN-415-R SHEET 4 OF 5 DATE 5-14-63

DESIGN REPORT

Summary Sheet



Typical X-Section

I.	Watershed data		
	A. Structure class	(a)	
	B. Drainage area	6,182	Ac.
	C. Time of concentration - T_c	4.2	Hrs.
	D. Hydrologic curve number - C_n		
	1. Moisture condition II	66	
	2. Moisture condition III	84	
II.	Principal spillway		
	A. Conduit		
	1. Size (I.D.)	10.25 Ft^2	In.
	2. Length	520	Ft.
	B. Riser		
	1. Size	3.5x10.5	Ft.
	2. Height	8.0	Ft.
	C. Weir length	19.3	Ft.
	D. Orifice size	--	in.
	E. Pond drain size	30	in.
III.	Emergency spillway		
	A. Width	250	Ft.
	B. Side slopes	2:1 and 2-1/2:1	
	C. Length of level section	100	Ft.
	D. Exit slope	0.0175	Ft/Ft.
	E. Maximum velocity at control section (D.H.W.)	9.02	Ft/Sec.
	F. Duration of flow (D.H.W.) through emergency spillway	38.3	Hrs.
	G. Frequency of use	< 1%	

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING & WATERSHED PLANNING UNIT
UPPER DARBY, PENNSYLVANIA

DRAWING NO. CK-413-R
SHEET 5 OF 5
DATE 5/29/63

CN - 60
JAN. 1959

GEOLOGY REPORT

BLACKBERRY RIVER WATERSHED
LITCHFIELD COUNTY, CONNECTICUT
CARLSONS' STATE LINE DAM - SITE NO. 15

REPORT NO. CN-413-G

T.R. Wire
Concurred by: T.R. Wire
State Conservation Engineer

William M. Brown
Prepared by: William M. Brown
Geologist, SCS, Storrs, Conn.

Rec'd 3/15/63 SCS

I. Introduction

A. General

State: Connecticut Location: Litchfield County

Watershed: Blackberry River Funds: WP-2-2

Site: Carlsons' State Line Dam - Site No. 15

Investigated by: William M. Brown, Geologist

Date: April to June 1961 Hazard: High

Equipment used: Acker Drill

Site Data:

Drainage Area: 9.65 sq. miles - 6177 acres

Type Structure: Compacted Earth

Purpose: Flood Prevention

Height of Fill: 75 feet; Length of Fill: 550 feet

Volume of Fill Required: 100,000 cubic yards

Location of Emergency Spillway: Left Abutment

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-413-G SHEET 1 OF 29 DATE 12/20/61

GEOLOGY REPORT

STORAGE ALLOCATION

	Depth at dam (feet)	Surface area (acres)	Volume (ac. ft.)
Sediment	11	8	26
Floodwater	68	150	3300

B. Surface Geology and Physiography

Site No. 15 is located in Northwestern Connecticut in the foothills of the Berkshire and Housatonic Highlands. The site is located in an area of generally moderate to steep relief with left and right abutments at the centerline of dam having slopes of 39 and 59 percent respectively. The approximate floodplain width is 85 feet. Bedrock is conspicuously exposed in the steep portion of the right abutment becoming overlain by a shallow mantle of glacial till as the slope lessens near top of dam. The bedrock type as exposed in the abutment is a highly oxidized, micaceous schist. This schist was also seen in a 5 foot hand dug pit at the foot of the opposite abutment. This micaceous schist is part of the gneissic complex of the Berkshire and Housatonic Highlands and is thought to be Precambrian. The left abutment and into the emergency spillway is fairly uniformly overlain by boulder till.

The apparent strike and dip as measured on the exposure is as follows: strike - N 45° E; dip - 67° SE. No geologic conditions such as seepage zones, faults, joint or fracture patterns were observed at the site which would adversely affect design or construction phases. Channel conditions at the proposed site are degrading and the channel sides are generally eroding.

II Subsurface Geology

A. Centerline of the Dam

Five holes were drilled along the centerline of the dam plus hole 201 in the emergency spillway which was close to the proposed centerline. Holes 1, 2, 303, 3 and 6 encountered bedrock with a maximum depth of overburden to bedrock being 49.0 feet in hole 303 at valley bottom. The estimated relative density of foundation materials ranges from loose to medium as

REFERENCE:	U.S.DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-413-G SHEET 2 OF 29 DATE 12/28/61

determined by blow count from Standard Penetration Resistance. The materials are wet, fine to coarse grained sand. The abutment holes contained essentially the same type materials except for being drier and more micaceous.

The bedrock as encountered in all holes drilled is a micaceous, weathered fine grained schist. In hole No. 1 however, 7 feet of gray quartzite capped the overlying schist. The schist is fairly soft as evidenced by the poor core recovery common to all holes. The schist has a fairly uniform dip of about 65-69°. The drill core when fractured follows this dip plane.

The foundation materials in the valley bottom consisting primarily of silty sands (SP-SM), were wet because of the high groundwater table. No specific acquifers were identified during the drilling.

B. Centerline of Principal Conduit

Five holes were drilled along the proposed axis of the conduit. Holes 301 and 302 were upstream from the centerline of dam; 303 was located at the approximate intersection of the axes of the centerline of dam and conduit; holes 304 and 305 were drilled downstream from the centerline of the structure. A highly micaceous schist was encountered in holes 302 and 303 at depths of 19 and 49 feet respectively. In hole 302 ninteen feet of drive sampling through SP-SM was required before the bedrock was hit. One hundred feet downstream at the centerline of dam and conduit in hole 303, forty-nine feet of SP-SM material was penetrated before bedrock was hit. In the downstream holes 304 and 305 drive sampling was performed to depths of 58 and 47 feet respectively without encountering bedrock. In hole 304 however, refusal was met at 58 feet. Upstream hole 301 was taken to a depth of 47 feet without refusal or bedrock being met. The hole depths served to point out the erratic bedrock surface which exists at depths following the valley profile. All of the holes except 305 exhibited a low blow count to full hole depth or bedrock surface. The blow count (except in hole 305) ranged from about 12 to 25 blows per foot.

C. Emergency Spillway

Eleven holes were drilled on a 100foot staggered grid to evaluate the subsurface materials and conditions. All holes

GEOLOGY REPORT

went at least 7 feet below the anticipated excavation grade. The material has tentatively been classified as SM in all of the holes drilled.

No bedrock was encountered at an above grade elevation in any of the holes drilled. Hole 202 which was located in the center of the control section, penetrated 5 feet of gray quartzite 11 feet below grade. In most holes 5-8 feet below grade a dense hardpan was met necessitating the use of an open-end sampler.

The material at the base of the excavation will be SM. Limestone boulders and weathered limestone fragments are common throughout the emergency section resulting in a generally high lime-content soil.

D. Borrow Areas

Drill holes and backhoe test pits were used to investigate and evaluate three borrow source areas including the emergency spillway section. Designated as Borrow Area "A", the emergency spillway section in addition to the 11 drill holes had 2 backhoe pits. Borrow Areas "B and C" are located on the left abutment approximately 1500 feet north or upstream of the structure. In Borrow Area "B", 8 drill holes and 9 backhoe pits were put in to determine the adequacy and availability of the material. Borrow Area "C" (slightly to the NW) had 8 drill holes and 6 backhoe pits. Classification of materials in the respective borrow areas is tentative pending laboratory analysis, and is based on visual identification and selected sieve analyses. The primary type of material available in the three borrow areas is SM. Borrow Area "A" has been classified entirely as SM. Borrow Area "C" has similarly been classifed and probably contains a higher percentage of silt and may be classified as SM or SM-ML. Borrow Area "B" is predominantly SM with some SP-SM and some minor quantities of SW-SM.

In Borrow Area "A" all of the excavated material from the emergency spillway should be adequate for use in the embankment. In Borrow Area "B" a minimum depth of 15 feet is available and probably up to 22 feet. The volume of fill available from this area alone exceeds the required amount for the embankment.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-413-G SHEET 4 OF 29 DATE 12/28/61

GEOLOGY REPORT

Pending laboratory analyses as to the suitability of the materials in Borrow Areas "A and B" it may be unnecessary to utilize Borrow Area "C".

Exploration Program

	Drill Holes	Backhoe Pits	Dist. Samples	U.S.C.S.
1. Centerline of Dam	6	-	-	-
2. Principal Spillway	5	-	-	-
3. Emergency Spillway	11	-	-	SM
4. Borrow Area "A"	11	2	1	SM
"B"	8	9	4	SM, SW-SM, SP-SM
"C"	8	6	5	SM or SM-ML

Summary of Findings

1. Centerline of Dam: Drilling along the centerline indicates a shallow depth to bedrock in the abutments and at the foot of the abutment. Hole 303 which was located at the intersection of the centerline of the dam and principal conduit went to a depth of 49 feet before bedrock was encountered. The bedrock is a weathered, micaceous fine grained schist. The measured dip of the bedding planes in the core is fairly consistent with the apparent dip in abutment outcropping and with the slope of the right abutment. This angle of dip and slope ranges from about 60° to 69°. The overlying sands in the valley bottom are wet throughout their entire vertical section and have an estimated low to medium relative density based on standard penetration resistance.

2. Principal Spillway: Five holes were drilled along the proposed axis of the conduit. The holes showed a highly erratic bedrock profile. The bedrock was undetected in holes 301 and 305 at depths of 47 feet; possibly in hole 304 as a zone of refusal at 58 feet; and in holes 302 and 303 at depths of 19 feet and 49 feet respectively.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-413-G SHEET 5 OF 29 DATE 12-28-61

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JAN. 1959

GEOLOGY REPORT

3. Emergency Spillway: Eleven holes were drilled in the proposed spillway section. All holes were carried to at least 7 feet below the proposed excavation grade. No bedrock was encountered in any of the holes within the proposed excavation limits.

4. Borrow: Three borrow source areas are available at the site. The excavated spillway material plus a secondary borrow area should well exceed embankment requirements with regard to volume and should preclude the use of the third borrow source area.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	DRAWING NO. CN-413-G SHEET 6 OF 29 DATE 12/20/61

Form SCS 533
Rev Dec 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan — Owner — State Connecticut
Watershed Blackberry River — Sub watershed Carlson's State Line — Site No. 15
Logged by M. M. Brown — Date May 1961 — Project: WPI — WPS X — FP — Pub 46
Drilling Equipment Acker Drill — Location of Holes Left Abutment

Hole No	Station and Surface Elev	Hole Depth From Ft	Hole Depth To Ft	Description of Materials	Unified Soil Class Symbol	BPF	Samples No	Type*	From Ft	To Ft	Rec %
~~1501~~		0	12.0	Sand, fine grained, poorly graded, micaceous, some decomposed schist fragments. "Hardpan" encountered at 10.0 feet.	SM	6	1	SS	0	2.0	100
						28	2	SS	5.0	7.0	100
						86	3	OE	10.0	12.0	42
		12.0	19.3	Quartzite, gray, fractured				Dia.	12'3"	15'4"	51
		19.3	21.4	Mica schist, gray, fine grained.				Dia.	15'4"	19'4"	25
								Dia.	19'4"	21'5"	48
~~1502~~	6+76	0	4.0	Sand, fine grained, poorly graded, micaceous.	SM	7	1	SS	0	2.0	42
	815.7	4.0	24.0	Highly micaceous schist.		35	2	SS	2.0	4.0	58
								Dia.	4.0	8.0	33
								Dia.	8.0	12.0	50
								Dia.	12.0	16.0	50
								Dia.	16.0	20.0	73
								Dia.	20.0	24.0	46

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* Disturbed undisturbed rock core. Percent sample recovery.
1 copy to E and WP Unit. 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

Sheet 7 of 29 Sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan — Owner — State Connecticut

Watershed Blackberry River — Sub-watershed Carlson's State Line — Site No 15

Logged by W. M. Brown — Date May 1961 — Project: WPI — WP? X — FP — Fub 46

Drilling Equipment Acker Drill — Location of Holes Right Abutment

Hole No.	Station and Surface Elev	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	BPF	Samples No.	Type*	From Ft	To Ft	Rec %†
~~15-3~~	7+82	0	6.0	Sand, fine grained, brown, poorly graded, very	SM	4	1	SS	0	2.0	83
	808.0			abundent mica.		5	2	SS	2.0	4.0	83
		6.0	12.0	Sand, fine to coarse grained, dark brown, very	SP	8	3	SS	4.0	6.0	83
				micaceous, some quartzitic fragments.		12	4	SS	6.0	8.0	83
	Tyc	12.0	32.0	Very micaceous schist, soft with poor core recovery.		19	5	SS	8.0	10.0	83
						20	6	SS	10.0	12.0	75
								Dia.	12.0	15.0	0
								Dia.	15.0	18.0	14
								Dia.	18.0	21.0	0
								Dia.	21.0	25.0	0
								Dia.	25.0	30.0	0
								Dia.	30.0	32.0	75
15-4	807.0	0	6.0	Sand, fine grained, brown, poorly graded, micaceous, some	SM	4	1	SS	0	2.0	50
				rounded quartzitic fragments.		5	2	SS	2.0	4.0	50
		6.0	18'9"	Sand, fine - medium grained, micaceous from decomposed	SP	10	3	SS	4.0	6.0	75
				schist fragments. Refusal at 18'9".		21	4	SS	6.0	8.0	58
						34	5	SS	8.0	10.0	54
						44	6	SS	10.0	12.0	83

B-23

* Disturbed-undisturbed rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan — Owner — State Connecticut

Watershed Blackberry River — Sub-watershed Carlson's State Line — Site No. 15

Logged by W. M. Brown — Date May 1961 — Project: WP1 — WP2 X — SP — Pub. 46

Drilling Equipment Acker Drill — Location of Holes Right Abutment

Hole No.	Station and Surface Elev.	Hole Depth From Ft	Hole Depth To Ft	Description of Materials	Unified Soil Class Symb	BPF	Samples No.	Type	From Ft	To Ft	Rec. %
15-4		18'9"*	38.0	Fine grained micaceous schist with occasional quartzitic veins.		37	7	SS	12.0	14.0	79
						25	8	SS	14.0	16.0	75
						25	9	SS	16.0	18.0	75
								Dia.	18'9"*	20.0	66
								Dia.	20.0	24.0	75
								Dia.	24.0	27.0	55
								Dia.	27.0	30.0	44
								Dia.	30.0	34.0	65
								Dia.	34.0	38.0	35
15-5	805.0	0	4.0	Sand, fine grained, dark brown, micaceous, some rock fragments. ~~Highly micaceous, from 4.6 feet.~~	SP-SM	4	1	SS	0	2.0	83
						5	2	SS	2.0	4.0	83
						15	3	SS	4.0	6.0	83
		4.0	6.0	Sand with less fines. Refusal at 6.0 feet.	SP			Dia.	6.0	11.0	80
		6.0	26.0	Fine grained gray micaceous schist.				Dia.	11.0	14.0	100
								Dia.	14.0	19.0	60
								Dia.	19.0	23.0	75
								Dia.	23.0	26.0	44

* Disturbed-undisturbed rock core. † Percent sample recovery

1 copy to E and WF Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

Sheet 9 of 29 Sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan
Owner
State Connecticut
Watershed Blackberry River
Sub-watershed Carlson's State Line
Site No. 15
Logged by W. M. Brown
Date May 1961 Project: WP1 WP2 X FP Pub 46
Drilling Equipment Acker Drill
Location of Holes Right Abutment

Hole No.	Station and Surface Elev	Hole Depth From Ft	Hole Depth To Ft	Description of Materials	Unified Soil Class Symb	BPF	Samples No	Type*	From Ft	To Ft	Rec %†
~~15-6~~	866.0	0	2.0	Sand, fine grained, poorly graded, some pebbles, micaceous.	SM	4	1	SS	0	2.0	83
						10	2	SS	2.0	4.0	83
		2.0	6.0	Sand, fine grained, more micaceous from decomposed schists. Refusal at 6.0 feet.	SP-SM	16	3	SS	4.0	6.0	83
								Dia.	6.0	11.0	27
		6.0	25.0	Very soft highly micaceous schist with numerous quartzitic veins.				Dia.	11.0	18.0	14
								Dia.	18.0	25.0	14

B-25

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit. 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location: East Canaan
Owner:
State: Connecticut
Watershed: Blackberry River
Sub watershed:
Site No. 15
Logged by: W. M. Brown
Date: May 1961 Project: WP1 WP2 X FP Pub 45
Drilling Equipment: Acker Drill
Location of Holes: Left valley side

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb	BPF xxx xxx xxxx	Samples No.	Samples Type*	Samples From Ft.	Samples To	Samples Rec. %
101	897.7	0	8.0	Sand, fine grained, poorly graded, brown, damp,	SM	4	1	SS	0	2.0	83
"				somewhat micaceous. From 2.0' feet becoming very fine		13	2	SS	2.0	4.0	83
"B				grained with some pebbles, increasing relative density.	SP-	37	3	SS	4.0	6.0	67
		8.0	10.0	Sand, fine grained, wea. rock fragments, pebbles, mica.	SM	44	4	SS	6.0	8.0	63
		10.0	15.0	Sand, fine grained, very dense, some mica.	SM	62	5	SS	8.0	10.0	63
						94	6	SS	10.0	12.0	67
15-102	921.4	0	22.0	Sand, fine grained, poorly graded, loose, silty, brown,	SM	4	1	SS	0	2.0	58
				very micaceous. Below 4.0' an increase in mica, some		13	2	SS	2.0	4.0	50
				gravel sizes and a medium relative density. From 10.0':		26	3	SS	4.0	6.0	58
				shattered quartz fragments and a color change from brown		36	4	SS	6.0	8.0	54
				to reddish brown due to oxidation. Very dense at 20.0		35	5	SS	8.0	10.0	58
				feet.		28	6	SS	10.0	12.0	50
						22	7	SS	15.0	17.0	58
						96	8	SS	20.0	22.0	58
				* SS = Split Spoon							

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* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WF Unit. 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist

CN-413-G

Form SCS-533
Rev. Dec 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location: East Canaan | Owner: | State: Connecticut
Watershed: Blackberry River | Sub watershed: | Site No. 15
Logged by: W. M. Brown | Date: May 19 62 | Project: WF1 | Auger: X | SP: | Pub 46
Drilling Equipment: Acker Drill | Location of Holes: Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Material	Soil Class (Unified)	BPF XXXX XXX XXXX	Samples No.	Samples Type	Samples From Ft.	Samples To Ft.	Samples Rec. %
15-103	950.2	0	22.0	Sand, very fine grained, silty, poorly graded, brown, pebbles (3-5%), trace of clay, very loose, micaceous.	SM	4	1	SS	0	2.0	100
	SM w/CL	0	8.0	From 2.0 feet: quartzitic rock fragments, loose.		10	2	SS	2.0	4.0	58
				From 4.0 - 10.0 - medium density. Gravel fraction		14	3	SS	4.0	6.0	58
				4.0 - 6.0'. Rotted mica schist fragments from 8.0-13.0'.		15	4	SS	6.0	8.0	50
				Hardpan encountered from 15.0 feet, very dense, gravel		18	5	SS	8.0	10.0	54
				fraction. Below 20.0' is very fine grained, light		15	6	SS	10.0	12.0	50
				brown, micaceous sand. Very dense - almost rock flour.		97	7	SS	15.0	17.0	58
				Last sample from open end.		147	8	OE	20.0	22.0	42
15-104	943.0	0	4.0	Sand, fine grained, poorly graded, mica.	SM	7	1	SS	0	2.0	54
						33	2	SS	2.0	4.0	58

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* Disturbed-undisturbed-rock core † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

Sheet 1 of 2 29 sheets

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Form SCS 533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub-watershed Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WPI [X] FP Pub 46

Drilling Equipment Acker Drill Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb	BPF XXX XXX XXXX	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. %
15-104	943.0	4.0	22.0	Sand, very fine to fine grained, poorly graded, highly micaceous. Very dense. All samples from open end.	SP-SM	102	3	OE	4.0	6.0	50
						42	4	OE	6.0	9.0	58
						29	5	OE	8.0	10.0	50
						36	6	OE	10.0	12.0	42
						42	7	OE	15.0	17.0	50
						110	8	OE	20.0	22.0	54
15-105	919.0	0	17.0	Sand, fine grained, poorly graded, brown, micaceous. Hardpan at 15.0 feet.	SM	5	1	SS	0	2.0	58
						29	2	SS	2.0	4.0	80
						39	3	SS	4.0	6.0	87
						44	4	SS	6.0	8.0	75
						51	5	SS	9.0	10.0	42
						58	6	SS	10.0	12.0	50
						170	7	SS	15.0	17.0	100

B-28

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan | Owner | State Connecticut

Watershed Blackberry River | Sub-watershed | Site No. 15

Logged by W. M. Brown | Date May 1961 | Project WP1 | AP X | FP | Pub 46

Drilling Equipment Acker Drill | Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	BPF xxx xxx xxx	Samples No.	Type*	From Ft	To Ft	Rec. %
15-106	931.3	0	16.0	Sand, fine grained, poorly graded, micaceous, some pebbles, brown, loose. Increase in density below 2.0'. Very micaceous from 6.0 feet. Below 10.0 feet Hematite staining and very micaceous. Refusal at 16.0 feet.	SM	5	1	SS	0	2.0	84
						12	2	SS	2.0	4.0	75
						14	3	SS	4.0	6.0	84
						18	4	SS	6.0	8.0	67
						34	5	SS	8.0	10.0	71
						44	6	SS	10.0	12.0	71
						185	7	SS	15.0	16.0	100
15-107	914.5	0	2.0	Sand, fine grained, poorly graded, brown, micaceous, some pebbles, loose density. Profile change at 2.0 feet.	SM	6	1	SS	0	2.0	75
						88	2	SS	2.0	4.0	79
		2.0	17.0	Hardpan, very fine grained, light brown sand, micaceous, poorly graded, pebbles and decomposed rock, very dense. No decomposed rock below 4.0'; subangular gravel sizes from 4.0'. Last sample from ~~0-2~~. open end	SP-	116	3	SS	4.0	6.0	58
						167	4	SS	6.0	8.0	63
						173	5	SS	8.0	10.0	50
						124	6	SS	10.0	12.0	58
						179	7	OE	15.0	17.0	33

B-29

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

CN-A13-G

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Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub-watershed Site No 15

Logged by W. M. Brown Date May 19 61 Project: WP1 WP2 X FP Pub 46

Drilling Equipment Acker Drill Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb	BPF xxx RR xxx	Samples No.	Type*	From Ft.	To Ft.	Rec † %
15-108	893.1	0	22.0	Sand, fine grained, poorly graded, micaceous, brown.	SM	5	1	SS	0	2.0	83
				trace of clay. Some quartzitic fragments from 2.0 ft.		12	2	SS	2.0	4.0	75
				Some white to rust colored decomposed rock at 20.0 feet.		14	3	SS	4.0	6.0	83
				Very dense from 15.0 feet.		18	4	SS	6.0	8.0	67
						34	5	SS	8.0	10.0	71
						44	6	SS	10.0	12.0	71
						117*	7	SS	15.0	16.0	100
				* 117 blows for 6 inches							

B-30

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

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Form SCS-513
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub watershed Site No 15

Logged by W. M. Brown Date May 1961 Project WPI WF X FF Pub 46

Drilling Equipment Acker Drill Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev	Hole Depth From Ft	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb	BPF ~~xxx~~ xxx Used	Samples No.	Type*	From Ft	To Ft	Rec %
15-150	884.17	0	2.0	Sand, trace of clay, brown, some mica, ML fraction.	SM-ML	15	1	SS	0	2.0	88
		2.0	8.0	Sand, silty, some medium to coarse sand from decomposed	SM	30	2	SS	2.0	4.0	92
				rock, some quartzitic fragments.		22	3	SS	4.0	6.0	83
						14	4	SS	6.0	8.0	75
		8.0	11.0	Sand, fine grained, brown, micaceous, poorly graded.	SP-SM	75	5	SS	8.0	10.0	58
		11.0	15.0	Quartzitic Schist.			6	Dia	11.0	15.0	10
15-151	881.1	0	7.0	Sand, fine grained, poorly graded, brown, some mica.	SM	6	1	SS	0	2.0	96
				Decrease in percentage of fines from 7.0 feet.		21	2	SS	2.0	4.0	42
		7.0	12.0	Sand w/o fines. Decomposed rock, some visible oxidation.	SP	57	3	SS	4.0	6.0	50
						57	4	SS	6.0	8.0	83
						121	5	SS	8.0	10.0	50
						197	6	SS	10.0	12.0	0
15-152	875.0	0	4.0	Sand, fine grained, poorly graded, micaceous w/abundant	SM	7	1	SS	0	2.0	92
				quartzitic fragments.		94	2	SS	2.0	4.0	50

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* Disturbed-undisturbed rock core. ! Percent sample recovery.
1 copy to E and WP Unit. 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

Sheet 1/6 of 29 Sheets

CN-413-G

Form SCS 533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut
Watershed Blackberry River Sub watershed Site No. 15
Logged by W. M. Brown Date May 1961 Project: WP1 WP2 X FP Pub 46
Drilling Equipment Acker Drill Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb	BPF XXX XXX XXX	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft	Samples Rec. %
15-153	869.3	0.0	2.0	Sand, very fine grained, poorly graded, brown, micaceous, some pebbles, loose.	SM	5	1	SS	0	2.0	58
		2.0	10.0	Same as above but with ML fraction.	SM-ML	13	2	SS	2.0	4.0	50
				Sand, very fine grained, poorly graded, brown, micaceous, with ML fraction, some pebbles, loose		19	3	SS	4.0	6.0	50
						30	4	SS	6.0	8.0	54
						41	5	SS	8.0	10.0	50
		10.0	12.0	Hardpan - sand, very fine grained, poorly graded, highly micaceous. Weathered mica achist.	SP	253	6	OE	10.0	12.0	75
15-154	881.9	0	10.0	Sand, very fine grained, micaceous, brown, poorly graded loose. Boulders and medium grained light brown sand at 6.0', also fragments from boulders and/or cobbles. Some coarser sand lenses at 8.0 feet.	SM	5	1	SS	0	2.0	83
						23	2	SS	2.0	4.0	83
						28	3	SS	4.0	6.0	83
						100	4	SS	6.0	8.0	83
		10.0	12.0	Sand, very fine grained, brown, micaceous, some rock fragments.	SP	31	5	SS	8.0	10.0	83
						-	6	OE	10.0	12.0	100

B-32

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan — Owner — State Connecticut

Watershed Blackberry River — Sub-watershed — Site No. 15

Logged by W. M. Brown — Date May 1961 — Project: WPI — W.O. I — FP — Pub. 46

Drilling Equipment Acker Drill — Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb.	BPF	Samples No.	Type*	From Ft.	To Ft.	Rec. %
15-155	892.5	0	2.0	Sand, very fine grained, brown, poorly graded, micaceous, medium density, pebbles present.	SM	12	1	SS	0	2.0	54
	Borrow C Sample	2.0	4.0	Sand, very fine grained as above but with angular quartzitic fragments, dense. pebbles present (shells)	SP-SM	31	2	SS	2.0	4.0	83
		4.0	12.0	Sand, fine grained, poorly graded, micaceous, subangular to angular rock fragments, very dense. Boulder drilled from 6.0 feet to 7.0 feet. Refusal at 12.0 feet.	SP	68	3	SS	4.0	6.0	67
							4	Dia	6.0	7.0	75
						211	5	SS	10.0	12.0	50
156	888.7	0	16.0	Sand, very fine grained, poorly graded, trace of clay, micaceous. Some rotted rock fragments contributing coarse fraction at 8.0 feet. Gravel sizes and pebbles from 10.0 feet. Hardpan at 16.0 feet.	SM-ML	7	1	SS	0	2.0	100
						20	2	SS	2.0	4.0	54
						24	3	SS	4.0	6.0	50
						26	4	SS	6.0	8.0	50
		16.0	18.5	Sand, fine to medium grained, some gravels, micaceous, well oxidized.	SP-SM	23	5	SS	9.0	10.0	54
						32	6	SS	10.0	12.0	46
		18.5	21.0	Hardpan, fine grained sand, pebbles and limestone fragments.	SP	134	7	SS	15.0	17.0	58
						309	8	SS	20.0	21.0	100

B-33

* Disturbed-undisturbed-rock core. F Percent sample recovery
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

CN-413-G

Form SCS-533
Rev. Dec 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan | Owner | State Connecticut

Watershed Blackberry River | Sub-watershed | Site No. 15

Logged by W. M. Brown | Date May 1961 | Project: WP1 ... WP2 X FP ... Pub 46 ...

Drilling Equipment Acker Drill | Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unified Soil Class. Symb	BPF xxx xxx xxx	Samples No.	Samples Type*	Samples From Ft	Samples To Ft.	Samples Rec %†
15-157	879.0	0	2.0	Silt, clayey, brown, micaceous, some very fine grained sand, pebbles.	ML	15	1	SS	0	2.0	67
		2.0	13.5	Sand, very fine grained, poorly graded, silty with a	SM-	22	2	SS	2.0	4.0	50
				trace of clay, brown, micaceous. Some decomposed mica	ML	28	3	SS	4.0	6.0	54
				schist, medium dense. From 6.0 feet to 10.0 feet, clay		27	4	SS	6.0	8.0	50
				is absent. Density increases at 8.0 feet. At 10.0 ft.		46	5	SS	8.0	10.0	50
				clay is present grading into fine grained silty sand.		55	6	SS	10.0	12.0	50
		13.5	22.0	Sand, fine grained, poorly graded, pebbles and rock	SP-	33	7	SS	15.0	17.0	54
				fragments, micaceous, dense. Well oxidized from 20.0 ft.	SM	121	8	SS	20.0	22.0	58
~~15-201~~	873.3	0	17.0	Sand, fine grained, poorly graded, angular quartz	SM	4	1	SS	0	2.0	83
				pebbles. Some coarse grained sand from decomposed and		16	2	SS	5.0	7.0	67
				weathered rock. Below 10.0 feet, sand is silty w/limey		43	3	OE	10.0	12.0	83
				rock fragments.		36	4	OE	15.0	17.0	83

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* Disturbed-undisturbed rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub-watershed Site No 15

Logged by W. M. Brown Date May 1961 Project: WPI W.U. X FP Pub. 46

Drilling Equipment Acker Drill Location of Holes Left Valley Side - Upstream

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb.	BPF XXX XX XXX	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. %
~~202~~	3+15	0	8.5	Sand, very fine grained, brown, poorly graded, some mica, pebbles, some limestone fragments.	SM-ML	4 18	1 2	SS SS	0 5.0	2.0 7.0	83 46
	719.0	8.5	22.0	Sand, fine grained, micaceous, medium relative density, angular limestone fragments. Refusal at 16.0 feet.	SM	19	3	SS	10.0	12.0	46
							4	SS	15.0	16.0	66
				Boulder drilled from 16.0 to 18.7 feet.				Dia	16.0	18.7	49
		22.0	27.8	Quartzite, gray		37	5	OE	20.0	21.5	66
								Dia	22.0	27.8	66

B-35

* Disturbed undisturbed rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS 533
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LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub watershed Site No. 15

Logged by W. M. Brown Date May 1961 Project NE1 WP X FP Pub 46

Drilling Equipment Acker Drill Location of Holes Left Abutment

Hole No	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif Soil Class Symb	BPF XXX XXX XXXX	Samples No.	Samples Type*	Samples From Ft	Samples To Ft.	Samples Re %
~~15-203~~	880.6	0	22.0	Sand, poorly graded, micaceous, subround quartz pebbles, loose to medium density, fine grained. Below 10.0 feet is decomposed schist fragments. Below 15.0 feet, very limey with weathered limestone fragments.	SM	5	1	SS	0	2.0	100
						16	2	SS	5.0	7.0	50
						45	3	OE	10.0	12.0	50
						56	4	OE	15.0	17.0	100
							5	OE	20.0	22.0	50
~~15-204~~	877.0	0	17.0	Sand, fine grained, some medium grained particles, brown, poorly graded, micaceous, some pebbles. Below 2.0 feet, material is primarily fine grained with some quartz pebbles.	SM	5	1	SS	0	2.0	100
						11	2	SS	5.0	7.0	67
						21	3	SS	10.0	12.0	50

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* Disturbed-undisturbed-rock core † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan | Owner | State Connecticut

Watershed Blackberry River | Sub-watershed | Site No. 15

Logged by W. M. Brown | Date May 19 61 | Project [illegible] | WP X | FP | Pub 16

Drilling Equipment Acker Drill | Location of Holes Left Abutment

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unified Soil Class. Symb	BPF XXX XX XXXX	Samples No.	Samples Type*	Samples From Ft	Samples To Ft	Samples Rec. %
~~15-205~~	876.0	0	17.0	Sand, fine grained, brown, micaceous, some ML fraction, poorly graded, some pebbles and quartzitic schist fragments. Below 5.0 feet schist fragments, medium density. Hardpan and weathered micaceous schist and pebbles encountered at 15.0 feet.	SM	5	1	SS	0	2.0	83
						20	2	SS	5.0	7.0	83
						29	3	SS	10.0	12.0	83
	Bed					95	4	SS	15.0	17.0	83
~~15-206~~	873.2	0	12.0	Sand, fine grained, poorly graded, brown, micaceous, well oxidized, very loose. Below 5.0 feet are some subround quartz fragments. Some limestone fragments from 10.0 feet.	SM	4	1	SS	0	2.0	75
						9	2	SS	5.0	7.0	67
						38	3	SS	10.0	12.0	67

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* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location **East Canaan** Owner State **Connecticut**

Watershed **Blackberry River** Sub-watershed Site No **15**

Logged by **W. M. Brown** Date **May** 19**61** Project WP1 WP, **X** SP Pub 45

Drilling Equipment **Acker Drill** Location of Holes **Left Abutment**

Hole No	Station and Surface Elev	Hole Depth From Ft	Hole Depth To Ft	Description of Materials	Unified Soil Class Symb	BPF	Samples No	Samples Type	Samples From Ft	Samples To Ft	Samples Per %
~~15-207~~	874.9	0	15.0	Sand, very fine grained, poorly graded, micaceous, some pebbles, well oxidized, very loose. Below 6.0 feet are limestone boulders and weathered limestone fragments. Hardpan encountered at 10.0 feet. Also, sand is coarser due to decomposed rock.	SM	4	1	SS	0	2.0	100
						34	2	SS	5.0	7.0	100
						40	3	SS	10.0	10.5	100
						80	4	OE	10.5	12.0	55
								Dia	15.0	17.0	33
		15.0	17.0	Altered limestone.							
~~15-208~~	880.0	0	18.0	Sand, very fine, micaceous, dark brown, poorly graded, some weathered rock fragments. Hardpan encountered at 10.0 feet. Hardpan limey, weathered limestone and quartzitic fragments. Refusal at 15.0 feet.	SM	2	1	SS	0	1.5	75
						9	2	SS	5.0	6.5	75
						50	3	SS	10.0	11.5	67
						140	4	SS	14.0	15.0	46
		18.0	21.0	Weathered limestone, quartz fragments with some yellow clay lenses, light tan, very dense.	SP	162	4A	OE	15.0	16.5	33
						103	5	OE	19.0	21.0	67
15-209	884.0	0	1.5	Sand, very fine to fine grained, brown, poorly graded, micaceous, well oxidized, some weathered rock fragments, very loose.	SM	4	1	SS	0	1.5	89
						21	2	SS	5.0	5.5	100
						21	3	SS	10.0	11.5	56

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* Disturbed undisturbed rock core † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan
Watershed Blackberry River
Logged by W. M. Brown
Drilling Equipment Acker Drill

Owner
Sub-watershed
Date May 1961 Project WP1 WP: X FF Pub 46
Location of Holes Left Abutment

State Connecticut
Site No. 15

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb	BPF XXX DDX XXX	Samples No.	Type*	From Ft	To Ft	Rec %
15-209	884.0	1.5	15.0	Sand, very fine grained, brown, highly micaceous from completely weathered schist. ML fraction. Below 10.0': quartz fragments and less mica, medium density.	SM-ML	47	4	OE	20.58	21.58	100
						149	5	OE	26.25	27.33	100
		15.0	16.5	Drilled Boulders							
		16.5	27.3	Hardpan, very limey, fine grained, poorly graded, sand. Some limestone fragments, very dense.	SM						
~~15-210~~	868.1	0	12.0	Sand, very fine grained, slightly micaceous, dry, brown, limestone fragments, poorly graded, loose relative density. Below 5.0 feet: decomposed schist fragments. Hardpan encountered at 10.0 feet - also fine grained sand and abundant quartz and limestone fragments.	SM	5	1	SS	0	2.0	50
						13	2	SS	5.0	7.0	50
						16	3	OE	10.0	12.0	38
~~15-211~~	865.4	0	7.0	Sand, fine grained, poorly graded, micaceous, brown, damp, some rock fragments, very loose.	SM	5	1	SS	0	2.0	100
						8	2	SS	5.0	7.0	100

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* Disturbed-undisturbed rock core † Percent sample recovery
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

Sheet 24 of 29 Sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut
Watershed Blackberry River Sub watershed Site No. 15
Logged by W. M. Brown Date May 19 61 Project: WPI WP) X FP Pub 46
Drilling Equipment Acker Drill Location of Holes Principal Spillway

Hole No.	Station and Surface Elev	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class Symb	BPF xx/xx/xxx	Sample No.	Sample Type*	Sample From Ft	Sample To Ft	Sample Rec %
15-301	806.3	0	2.0	Sand, fine to medium grained, poorly graded, micaceous.	SP	3	1	SS	0	2.0	79
		2.0	4.0	Sand as above with more fines, gravels and pebbles from 4.0 feet. b fine grained sands, poorly graded, micaceous,	SP-SM	12	2	SS	2.0	4.0	58
						46	3	SS	4.0	6.0	71
		14.0	28.5	Sand, fine to medium grained, poorly graded, clean, micaceous. At 25.0 feet coarser sands from decomposed rock. Fine sands, poorly graded, clean, micaceous	SP	41	4	SS	6.0	8.0	87
						47	5	SS	8.0	10.0	75
						17	6	SS	10.0	12.0	54
		28.5	38.5	Same as above with more fines.	SP-SM	34	7	SS	12.0	14.0	67
		38.5	47.0	Sand, fine to medium grained, poorly graded, micaceous, rock fragments.	SP	21	8	SS	14.0	16.0	96
						13	9	SS	16.0	18.0	71
						7	10	SS	18.0	20.0	62
						9	11	SS	20.0	22.0	100
						9	12	SS	25.0	27.0	100
						32	13	SS	30.0	32.0	58
						22	14	SS	35.0	37.0	67
						17	15	SS	40.0	42.0	100
						14	16	SS	45.0	47.0	79

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* Disturbed undisturbed rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist.

CW-413-G

AD-A144 549 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
WHITING RIVER DAM (CT..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV FEB 81

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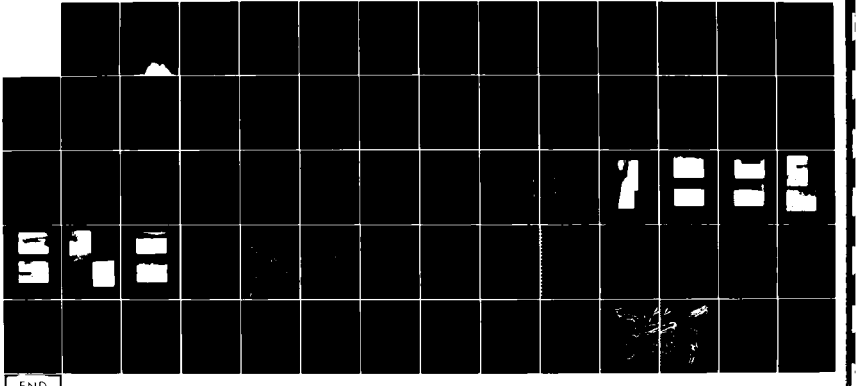

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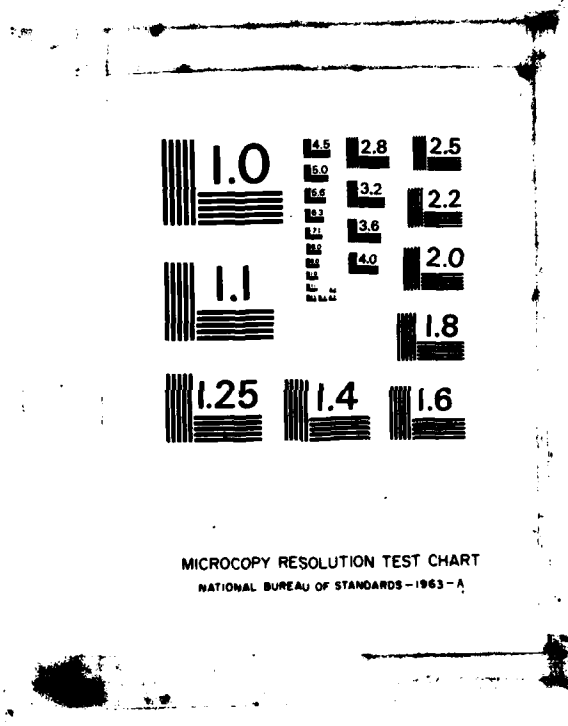
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub watershed Site No 15

Logged by W. M. Brown Date May 1961 Project WPJ W.O. X F. Pub 46

Drilling Equipment Acker Drill Location of Holes Principal Spillway

Elevation and Top of Hole Elev	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unified Soil Classification Symbol	BPF XXX XX XXX	Samples No.	Samples Type	Samples From Ft.	Samples To Ft.	Samples Rec. %
[illegible].3	0	2.0	Sand, fine to coarse grained, organic order, micaceous, brown to gray.	SM	8	1	SS	0	2.0	58
					29	2	SS	2.0	4.0	67
	2.0	18.7	Sand, fine to coarse grained, well oxidized, micaceous, brown, gravel fragments. Abundant decomposed rock at 4.0 feet. Sand becoming primarily fine grained at 6.0 feet. Very loose at 11.0 feet. Refusal at 18'8".	SP-SM	68	3	SS	4.0	6.0	54
					(31)	4	SS	6.0	8.0	33
					24	5	SS	8.0	10.0	37
					23	6	SS	10.0	12.0	25
[illegible].7			Micaceous schist, gray, very fine grained.		12	7	SS	12.0	14.0	33
					5	8	SS	14.0	16.0	25
					11	9	SS	16.0	18.0	46
							Dia	18.7	23.7	17
							Dia	23.7	28.7	3
							Dia	28.7	33.7	12

[illegible]-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit. 1 copy Soil Mechanics Laboratory with samples
Other copies as directed by State Conservationist

Sheet 26 of 29 sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub watershed Site No. 15

Logged by W. M. Brown Date May 1961 Project WP1 WP2 X FP Pub 46

Drilling Equipment Acker Drill Location of Holes Principal Spillway

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unit Soil Class. Symb.	BPF	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec %‡
~~15-303~~	7+27 803.5	0	~~2.0~~	Sand, fine to medium grained, gray, micaceous, poorly graded. (fine grained sand, gray, micaceous, poorly graded)	SP	4	1	SS	0	2.0	71
						11	2	SS	2.0	4.0	75
		~~2.0~~	~~49.0~~	Sand as above with more fines. Some gravels throughout.	SP-	(27)	3	SS	4.0	6.0	58
				Sand becoming fine to coarse at 18.0 feet; becoming fine	SM	19	4	SS	6.0	8.0	75
				grained at 35.0 feet. Refusal at 49.0 feet.		13	5	SS	8.0	10.0	29
		49.0	49.0	1 foot of white quartzite then remainder of hole micaceous		13	6	SS	10.0	12.0	33
				schist.		15	7	SS	12.0	14.0	54
						7	8	SS	14.0	16.0	58
						10	9	SS	16.0	18.0	62
						20	10	SS	18.0	20.0	10
						15	11	SS	20.0	22.0	0
						17	12	SS	25.0	27.0	54
						19	13	SS	30.0	32.0	58
						11	14	SS	35.0	37.0	17
						15	15	SS	40.0	42.0	50
						14	16	SS	45.0	47.0	42
								Dia.	49.0	54.0	44
								Dia.	54.0	59.0	26
								Dia.	59.0	64.0	20
								Dia.	64.0	69.0	24

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* Disturbed-undisturbed-rock core. ‡ Percent sample recovery
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

CN-413-G

Form SCS-533
Rev. Dec 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan Owner State Connecticut

Watershed Blackberry River Sub watershed Site No. 15

Logged by W. M. Brown Date May 19 61 Project WF1 WP X FP Pub. 46

Drilling Equipment Acker Drill Location of Holes Principal Spillway

Hole No	Station and Surface Elev.	Hole Depth From Ft	Hole Depth To Ft	Description of Materials	Unified Soil Class Symb.	BPF	Samples No.	Samples Type	Samples From Ft.	Samples To Ft	Samples Rec. %
15-304	803.7	0	2.0	Sand, fine to medium grained, poorly graded, micaceous, pebbles, dark brown, loose.	SP-SM	5	1	SS	0	2.0	33
		2.0	4.0	Sand, fine to coarse grained, poorly graded, pebbles and gravel sizes, medium density, micaceous.	SM	26	2	SS	2.0	4.0	33
					SM	29	3	SS	4.0	6.0	50
						32	4	SS	6.0	8.0	54
		4.0	6.0	Sand, well graded, micaceous, ranges from fine grained to gravels, dark gray. Medium density.	SW-SM	30	5	SS	8.0	10.0	58
					SM	25	6	SS	10.0	12.0	58
		6.0	8.0	Sand, primarily fine to medium grained, dark gray, micaceous, some gravel sizes, dense.	SP-SM	28	7	SS	12.0	14.0	54
					SM	29	8	SS	14.0	16.0	44
		~~8.0~~	~~13.5~~	Gray, micaceous, subround quartz gravel sizes, medium dense. Grading improves from 12.0 feet to 16.0 feet. Medium grained at 18.0 feet. Below 20.0 feet gravels.	SP	29	9	SS	16.0	18.0	50
						30	10	SS	18.0	20.0	46
						15	11	SS	20.0	22.0	50
		~~13.5~~	~~53.5~~	Sand as described above with more pebbles and fines.	SP-SM	18	12	SS	25.0	27.0	42
					SM	27	13	SS	30.0	32.0	58
		53.5	58.0	Sand, well graded, gravels.	SW-SM	dense		SS	35.0	37.0	0
		8.0	20.0	sand, gray, micaceous, with subround quartz gravel sizes,	medium	16	14	SS	40.0	42.0	33
		20.0	43.5	gravel, subround quartz, medium dense		7	15	SS	45.0	47.0	37
		43.5	53.5	fine sand, gray, micaceous with subround quartz grave sizes, pebbles.		7	16	SS	50.0	52.0	42
						39	17	SS	55.0	57.0	0

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* Disturbed undisturbed-rock core. † Percent sample recovery
1 copy to E and WP Unit. 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

CN-413-G

Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location East Canaan | Owner | State Connecticut

Watershed Blackberry River | Sub watershed | Site No. 15

Logged by W. M. Brown | Date May 1961 | Project WP1 | WP2 X | FP | Pub 46

Drilling Equipment Acker Drill | Location of Holes Principal Spillway

Hole No.	Station and Surface Elev.	Hole Depth From Ft	Hole Depth To Ft.	Description of Materials	Unified Soil Classification Symb	BPF xxxx xx xxxx	No.	Type	Samples From Ft	Samples To Ft.	Samples Rec. %
15-305	803.5	0	8.5	Sand, well graded to gravels, Abundant river alluvium.	SW SP-	5	1	SS	0	2.0	83
		8.5	18.5	Sand, ~~coarse grading than above~~ poorly graded, dark gray, some mica. Boulders 12.0 feet to 14.0 feet.	SM	49	2	SS	5.0	7.0	83
						26	3	SS	10.0	12.0	83
		18.5	47.0	Sand, medium to coarse grained, some angular quartzitic fragments, micaceous.	SP			Dia	12.0	14.0	50
						28	4	SS	15.0	17.0	42
						34	5	SS	20.0	22.0	50
						46	6	SS	25.0	27.0	46
						60	7	SS	30.0	32.0	50
						81	8	SS	35.0	37.0	42
						81	9	SS	40.0	42.0	46
						82	10	SS	45.0	47.0	42

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* Disturbed-undisturbed-rock core † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Sheet 29 of 29 sheets

CN-413-G

CN - 6
JAN. 1949

GEOLOGY REPORT

INTERPRETATIONS AND CONCLUSIONS
"For in Service Use Only"

1. Centerline of Dam:

   A. The topography at the site along the approximate centerline of dam is the direct result of bedrock expression. The bedrock which is exposed in the right abutment and within 4 feet at the foot of the left plunges steeply beneath the valley floodplain to a depth of 49 feet at centerline. The bedrock profile has probably been developed as a result of erosion and subsequent shearing along [redacted] weathered steeply dipping bedding planes. As a result of the weathered condition of this highly micaceous schist, the rock is soft and can easily be worked. There was no indication during drilling such as water loss or dropping of rods that any fractures or gaps exist along these bedding planes. However the poor core recovery is attributed to the softness of the rock and shearing along these dip planes. The use of a key to prevent slippage of the embankment against the bedrock face (on the abutments) may be required because of the severe angle of dip of the bedrock.

   B. The sands throughout most of the foundation have an estimated low to medium relative density based on blow count from standard penetration resistance. The low blow count can probably be attributed to several reasons - all related to the presence of water. Water is present throughout all of the foundation sands. No individual acquifer was identified as a result of the drilling. The presence of water is due to the estimated high permeability of the sands, the trapping of water as a result of bedrock constriction, and side drainage following steeply dipping bedrock. The low blow count continues through the whole vertical section of sand. Because of the wet foundation conditions, drainage will undoubtedly be required in form of a horizontal drainage blanket and toe drain.

2. Emergency Spillway:

   A. No bedrock excavation is anticipated in the emergency spillway section. Conventional earth moving equipment should adequately handle the stripping operation. The quartzite which was evidenced in holes 1 and 202 is probably a bedrock capping rather than random boulders. In each of the two holes the quartzite unconformably overlies the fine grained schist i.e., the bedding planes within the quartzite are horizontal in relation to the steeply dipping bedding planes of the underlying schist. This

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE B-45	DRAWING NO. CN-113-G SHEET 1 OF 7 DATE 11/26/41

GEOLOGY REPORT

unconformity although known to exist is not commonly evidenced within Connecticut.

B. The emergency spillway has been designated as borrow area "A" and should provide approximately 30,000 cubic yards of SM material.

3. Principal Spillway:

A. As indicated in the preceding paragraph under "Centerline of Dam" the materials in the valley bottom have an estimated low to medium relative density because of the presence of water. Only in hole 305 does the material become increasingly dense. This is probably due to the absence of bedrock allowing for greater lateral movement of groundwater since the sands are essentially the same in all holes.

B. The 5 drill holes along the axis of the proposed conduit delineated a highly irregular bedrock profile. The bedrock as encountered in holes 302 and 303 is the same soft micaceous schist as was found in the other foundation holes.

C. Some consideration should be given to placing the conduit at the foot of the right abutment because of greater foundation stability. Depth to bedrock is shallower and the presence of the bedrock more predictable as evidenced in holes 3, 4 and 5. If the conduit is relocated, some bedrock excavation may be required to reach the prescribed grade at the outlet. This should present little difficulty since the bedrock is soft. Upstream, depth to bedrock may exceed the grade limits and compacted fill would be required.

4. Borrow:

Three areas were investigated for borrow source and have been designated "A, B, and C" in order of priority. Borrow Area "A" will be from the zone of excavation in the emergency spillway. Borrow Areas "B and C" are approximately 1500 feet upstream from the structure on the left valley side. It is estimated that sufficient material will be available from "A and B" and that "C" area will not have to be utilized.

In borrow area "B" several sieve analyses were run to classify the material. The area is predominently SM but test pits 113 and 114 sieve as an SP-SM (each with 11.5% passing No. 200) and test pit 112 as SW-SM (10.4% passing No. 200). The percentage of fines run so close to being in excess of 12% that

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JAN. 1959

GEOLOGY REPORT

the entire borrow area is being regarded as SM. The following summarizes the borrow material available at the site:

Borrow Area	Acres	Depth (feet)	Volume (cu. yds.)	U.S.C.S.	Use
A	Emergency Spillway	-	~~30,000~~	SM 2603	Embankment
B	10.4	15	251,600	SM	Embankment
C	3.1	7	35,000	~~SM~~ SM-ML 2605	Embankment

Two grain size distribution curves for test pits 118 and 124 are included for your reference. Where are they?

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE B-47	DRAWING NO. CN-413-G SHEET 3 OF 7 DATE 12/26/61

Roy S. Decker, Head, Soil Mechanics Laboratory
SCS, Lincoln, Nebraska

December 27, 1961

N. Paul Tedrow, State Conservationist, SCS,
Storrs, Connecticut

ENGINEERING - Geologic Site Investigation, Site No. 15,
Blackberry River Watershed, Connecticut

Following is some pertinent data relative to the geologic site investigation which was performed on the above site.

The proposed floodwater detention structure crosses a steep-sided valley whose floodplain is approximately 65 feet in width. The structure will be 75 feet high and approximately 550 feet long. The volume of fill required for the embankment is about 100,000 cubic yards.

Bedrock governs the topographic expression at the site. A highly micaceous and weathered fine grained schist is exposed in the right abutment and within 4 feet on the left abutment. The bedrock following the profile for centerline of dam plunges steeply (about 65°- 69°) to a depth of 49 feet below the existing valley floor. Along the centerline profile for the principal conduit, bedrock was encountered at 19 feet in hole 302, 49 feet in 303, and not encountered downstream in hole 309 at 58 feet. However refusal was encountered at that depth.

The foundation materials consists primarily of SP and SP-SM. The sands were wet throughout their entire vertical section. They have an estimated low to medium relative density based on blow count from standard penetration resistance. No individual acquifers were identified during drilling. The low blow count can probably be attributed to several factors - all related to the presence of water. The presence of water is due to an estimated high permeability of the sands, the trapping and resultant impedance of groundwater caused by the constriction of bedrock in the valley bottom and side drainage following steeply dipping bedrock.

The bedrock is soft as evidenced by poor core recovery and has well defined steeply dipping bedding planes. No sudden loss of water or dropping of rods were reported during drilling which would indicate fracturing or gaps in the bedrock.

Three disturbed samples each from 3 proposed borrow areas are being sent for appropriate analysis. Also a composite sample representing typical foundation sands is being sent along with a proposed filter envelope for a blanket drain against these sands. We would appreciate your concurrence on the proposed filter criteria or other suitable recommendations.

SCS 35a, b, c, the geology report, and SCS 533's after being reviewed by Upper Darby, will be routed to you through Beltsville, Md., Cartographic after reproduction has been made.

Enclosures:
1 Cov't. B/L
1 SCS 534
1 SCS 347
(spread sheet for analyses)
2 SCS 356
4 SCS 353a

cc: T.R. Wire
P.F. Fonner
W. H. Brown
control file

WHBrown:reb

Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location Litchfield County Owner _____ State Connecticut

Watershed Blackberry River Sub-watershed _____ Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WP1 ____ WP2 X FP ____ Pub. 46 ____

Drilling Equipment Tractor-Mounted Backhoe Location of Holes Borrow "B"

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. † %
112		0	1.5	Topsoil, sand, very fine grained, poorly graded.	SM		1	DS	3.0	8.0	
		1.5	8.0	Sand, fine grained, poorly graded, very micaceous,	SM						
				fragmental mica schist, low percentage (less than 5%)							
				of cobbles and boulders.							
113		0	1.0	Topsoil, sand, very fine grained, poorly graded.	SM		1	DS	2.5	6.0	
		1.0	6.5	Sand, fine grained, poorly graded, micaceous. Cobbles	SM						
				and boulders estimated at 10% respectively. Hole							
				bottomed on 2 boulders.							
114		0	1.0	Topsoil, sand, very fine grained, poorly graded.	SM		1	DS	3.0	8.5	
		1.0	4.0	Sand, fine grained, poorly graded, micaceous, brown.	SM						
		4.0	9.3	Sand as above with less fines, probably hardpan,	SP-SM						
				abundant fragmental rock estimated 5 to 10% not in							
				excess of 4 inches.							

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location Litchfield County Owner _____ State Connecticut

Watershed Blackberry River Sub-watershed _____ Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WP1 ___ WP2 X FP ___ Pub. 46 ___

Drilling Equipment Tractor-Mounted Backhoe Location of Holes Borrow "B"

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. † %
115		0	1.1	Topsoil - as previous	SM						
		1.1	6.2	Sand, fine grained, poorly graded, brown micaceous,	SM						
				abundant boulders at 6.0 feet.							
116		0	1.0	Topsoil - as previous.	SM						
		1.0	7.4	Sand - as described in 115 with no boulders.	SM						
117		0	0.8	Topsoil, as previous.	SM						
		0.8	3.0	Sand, very fine grained, poorly graded, brown,	SM						
				micaceous, pebbles and some fragmental rock.							
		3.0	8.0	Sand, fine grained - otherwise similar to above, some-	SP						
				what denser.							

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Sheet 2 of 5 Sheets

Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location Litchfield County Owner _____ State Connecticut

Watershed Blackberry River Sub-watershed _____ Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WP1 ____ WP2 X FP ____ Pub. 46 ____

Drilling Equipment Tractor-Mounted Backhoe Location of Holes Borrow "B"

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. † %
118		0	1.2	Topsoil - as previous	SM						
		1.2	9.0	Sand, fine to medium grained, poorly graded,	SM						
				Micaceous, some fragmental rock and cobbles.							
119		0	1.0	Topsoil - as previous	SM						
		1.0	7.0	Sand, fine grained, poorly graded, brown, micaceous,	SP-						
				fragmental rock throughout. Hardpan at 4.0 feet.	SM						
				Fragmental rock estimated 5 to 10%; boulders 5%.							
120		0	1.0	Topsoil - as previous	SM		1	DS	3.0	8.0	
		1.0	8.3	Sand, very fine grained, poorly graded, some fine to	SM						
				medium grained sand lenses with small pebbles and iron							
				oxide cementation, micaceous. Boulders and cobbles							
				estimated 5 to 10%.							

* Disturbed-undisturbed-rock core. † Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Sheet 3 of 5 Sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location Litchfield County Owner _____ State Connecticut

Watershed Blackberry River Sub-watershed _____ Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WP1 ___ WP2 X FP ___ Pub. 46 ___

Drilling Equipment Tractor-Mounted Backhoe Location of Holes Borrow "C"

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. % ‡
121		0	1.0	Topsoil - as previous	SM		1	DS	4.0	9.0	
		1.0	9.0	Sand, fine grained, poorly graded, micaceous, brown,	SM						
				boulders 3.0 to 4.5 feet - somewhat quartzitic. No							
				boulders below 4.5 feet, cobbles estimated 5% from 4.5.							
122		0	0.7	Topsoil - as previous	SM						
		0.7	7.5	Sand, same as above with more boulders throughout;	SM						
				estimated 10-15%.							
123		0	0.6	Topsoil - as previous.	SM		1	DS	2.5	8.0	
		0.6	8.5	Sand, fine grained, poor grading, some mica, very minor	SM						
				medium to coarse sand. Boulders from 4.0 feet 75%.							
				Very fine grained from 4.0 feet, abundant totally							
				decomposed gneiss, some limestone fragments.							

* Disturbed-undisturbed-rock core. ‡ Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Sheet 4 of 5 Sheets

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Form SCS-533
Rev. Dec. 58

LOG OF TEST HOLES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Location Litchfield County Owner _____ State Connecticut

Watershed Blackberry River Sub-watershed _____ Site No. 15

Logged by W. M. Brown Date May 19 61 Project: WP1 ___ WP2 X FP ___ Pub. 46 ___

Drilling Equipment Tractor-Mounted Backhoe Location of Holes Borrow "C"

Hole No.	Station and Surface Elev.	Hole Depth From Ft.	Hole Depth To Ft.	Description of Materials	Unif. Soil Class. Symb.	Type Bit Used	Samples No.	Samples Type*	Samples From Ft.	Samples To Ft.	Samples Rec. ‡ %
124		0	0.6	Topsoil - as previous	SM						
		0.6	8.0	Sand, fine grained, poorly graded, brown, micaceous,	SM						
				fragmental rock, cobbles, boulders throughout.							
125		0	1.0	Topsoil - as previous	SM						
		1.0	9.0	Sand, very fine grained, poorly graded, brown,	SM-						
				slightly plastic, some rotted fragmental rock, some mica.	ML						
126		0	0.9	Topsoil - as previous	SM						
		0.9	9.0	Sand, same as 125	SM- ML		1	DS	3.0	9.0	

* Disturbed-undisturbed-rock core. ‡ Percent sample recovery.
1 copy to E and WP Unit, 1 copy Soil Mechanics Laboratory with samples.
Other copies as directed by State Conservationist.

Sheet 5 of 5 Sheets

B-54

DETERMINING ADEQUACY OF SITE INVESTIGATION

Site Name Blackberry River Watershed No. 15 Structure Class C

Reviewed by _____, J. M. Zurlo Date Jan 3, '62
Engineer Geologist

Height 75' Length 550' Vol. Fill Required 70,000 c.y.

A. Borrow

1. Are adequate quantities available? Yes

Location	U.S.C.S.	C.Y. Available
A. (Emergency Spillway)	SM	30,000
B. } 1500' upstream from	SM	251,600
C. } structure on left valley side	SM SM-ML	35,000

2. Is filter material available at or near the site? yes
Gradation _____ Sample _____ Quantity available _____ c.y.

3. Is soil sample list, SCS-534, attached? No

4. Has each major embankment material at the site been sampled for complete laboratory tests? yes

B. Foundation

1. Consolidation and shear strength
   a. Does < 20 blow-count material exist? yes
   b. Have undisturbed samples been taken? No
   If not, does report or tests explain reason? Yes

2. Are water levels and pervious zones logged in logs and on profiles? yes

3. Has each distinct foundation material been sampled for sieve and/or mechanical (hydrometer) analysis? yes If not, does report contain correlation guidance to similar borrow samples? —

4. Have samples been obtained from the foundation drain location or correlated to other samples taken from the site? yes Flood plain? yes (Composite)
Embankments? yes (For filter design).

5. Bedrock characteristics
   a. Weathered (soft)? ✓
   b. Firm (hard)? ✓
   c. Bedding thickness? ✓
   d. Strike and dip? ✓
   e. Formations - Age? ✓
   f. Fractures and/or cavity locations and descriptions? ✓ Water or permeability tests or remarks? ✓
   g. Confirmation of bedrock or boulders? ✓

6. Did borings extend to sufficient depth to establish stable and impermeable materials? yes

7. Have water or permeability tests available or sufficient remarks to determine k values by Bur. of Rec. methods, E-18 or E-19, Earth Manual. Or can it be estimated by D_{10} and dry density (Slichter). Table VII-2 Principls of Soil Mechanics (Preliminary, 1959) from sample data? yes See B-3 above.

C. Principal Spillway

1. Are foundation locations adequate? yes Yielding? yes Non-Yielding? ____
2. Are alternate locations more favorable? possibly Why? ____
   At foot of right abutment conduit would be located on a more stable foundation since bedrock is shallower and also its presence is more precictable
3. Have test data or samples been obtained to be used to determine loading and elongation? yes
4. Foundation of riser sample or test data? yes (blow count data)
   Bent foundation condition sample or test data sufficient? yes
5. Outlet channel logs or correlation information? No Any indication of rock excavation? No - Soil in channel bens

D. Emergency Spillway

1. Do test holes extend to or below proposed spillway grades or elevations? yes
2. Are there sufficient holes to compute quantities of rock excavation? yes
3. Are rock descriptions or correlations adequate to determine rippability or ease of removal? yes
4. Are seepage zones or water levels described and located? ✓ (No seepage zones mentioned in report)
   Sampled for drains? yes
5. Are soils described or sampled to determine erodibility? yes
   Possible use in embankments? yes

C1. Foundation is considered yielding due to low relative density of materials under the conduit. Also due to the erratic surface of the bedrock differential settlement may occur.

D2. No bedrock excavation is anticipated

A2. gradation curves sent to Lincoln (none sent to EcolPunit.)

Aug t 1962

T. R. Wire, State Conservation Engineer, SCS, Storrs, Connecticut

March 14, 1962

Roy S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

Connecticut WP-[illegible], Blackberry River, Site No. 15

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS 355, Triaxial Shear Test Data, 3 sheets.
3. Form SCS 35[illegible], Compaction and Penetration Resistance Report, 3 sheets.
4. Form SCS 353, Filter Material, 1 sheet.
5. Form SCS 357, Summary - Slope Stability Analysis, 2 sheets.
6. Geological Plans and Profiles.

INTERPRETATION AND DISCUSSION OF DATA

FOUNDATION MATERIALS:

A. Classification: The site is on a highly micaceous schist bedrock, which is weathered to a greatly variable degree, based on rock recovery percentages.

Water table information was not found in the logs but hints in the Geology Report indicate it may be at the surface in all holes.

The surface sand classed as SM-SP.

B. Permeability: Permeability tests were not made. In general, the surface materials, based on blow count and gradation appear to be more permeable than the deeper materials. There may be some density variations and drainage should be deep as practicable.

C. Consolidation: Based on the blow counts and description of materials, the consolidation potential is not great. An estimated 1/2% may occur in the 40' of unconsolidated, well-graded medium sand.

Settlement will occur rapidly and over half should be complete at the end of construction.

D. Shear Strength: Shear Strength in the foundation is hard to estimate. A limiting value was obtained by running a direct shear test on Sample 62W260[illegible] at its minimum possible density. The specimens were made by pouring the sand into the mold loosely and letting it consolidated under lateral pressures before shearing while flooded with water. A shear value of $\phi = 27°$, $c = 0$ was obtained. The foundation is not real loose so a value of $\phi = 30°$, $c = 0$ may be more realistic.

2 — T. B. Wire — 3/14/[illegible]
Roy E. Becker
Subj: Connecticut WP-[illegible], Blackberry River, Site No. 15

EMBANKMENT MATERIALS:

A. Classification: Borrow samples submitted were all non-plastic SMs with variable fine and gravel contents and some mica.

B. Compacted Densities: Standard Proctor compaction on the < ¾ size portion yielded maximum dry densities that vary from 109.0 p.c.f. to 117.5 p.c.f. Rock corrections are shown on SCS # 352.

C. Shear Strength: Samples 62-2603 and 2604 were tested in triaxial shear. The specimens were compacted to 95% of Standard density and saturated before shearing. Some question exists as to the degree of saturation reached. It is believed the cohesion intercept shown on the test of 62-2604 was due to its not being saturated. Best values of $\phi = 31°$, $c = 0$ for 62-2603 and $\phi = 30.5°$, $c = 0$ for 62-2604 are believed representative.

STABILITY ANALYSIS:

Slope stability was checked by three methods as follows:

1. An infinite slope with rapid drawdown such that the flow lines are horizontal with seepage onto the slope was assumed. For $F_s = \frac{(\gamma_s \cos^2 \theta - \gamma_w) \tan \phi}{\gamma_s \sin \theta \cos \theta}$ and $\gamma_s = 130$ p.c.f., $\phi = 30°$ ($\tan \phi = 0.577$), $\theta = 14° 57'$, a safety factor of 1.05 was computed for a 3 3/4:1 upstream slope.

2. Based on ratio of the tangent ϕ of the material to the tangent of the 2 1/2:1 drained downstream slope, a safety factor of 1.44 is computed.

3. Deep failures into the foundation were checked by a Swedish Circle Method. The limiting shear value found by test of $\phi = 30°$, $c = 0$ was used for both embankment and foundation. A summary is shown.

   A 3 3/4:1 upstream slope required a 40' berm at elevation 830.0 to provide a 1.49 safety factor. A 2 1/2:1 downstream slope requires a 33' berm at elevation 830.0 to provide a safety factor of 1.50.

CONCLUSIONS AND RECOMMENDATIONS

A. Site Preparation: Overhangs and loose rock or very loose sands should be removed from the entire base of the dam.

B. Cutoff: A core trench is recommended in the left abutment and the valley bottom. A positive cutoff is not expected and the trench should be deep enough only to intercept loose surface material, root holes, animal burrows, etc. A key way should be made into the firm rock in the right abutment. A bottom width of 30' is recommended to provide working room and better bond to rock surfaces.

3 -- T. R. Wire -- 3/14/62
Re: S. Decatur
Subj: Connecticut WP-_, Blackberry River Site No. 15

Backfill with the most plastic material available. If a material with some plasticity cannot be found, bentonite might be mixed with fine sand to place against the rock contacts in the cutoff and immediately around the conduit.

C. Principal Spillway: A more desirable location would appear to be available near the right abutment at about ℄ Station 7+90. A skew toward the left of about 15° to 20° may be best.

It is believed the conduit in this location can be cradled on rock and no camber or need for special joints will exist.

D. Drainage: A trench drain at c/b = 0.6 with a pipe or rock toe outlet is recommended. It should bottom against the rock or extend to 15' depth where rock is not contacted. The drain should extend up both abutments as a relatively narrow (20' width) blanket drain, to the emergency spillway level.

The filter material limits suggested in the Geologic Report is a little wide to protect even the coarsest embankment, 62W604. We have outlined the limits as applicable to the coarse borrow and the foundation samples we received. The limits shown can be used with 3/8" to 3/4" pipe slots or against a rock toe with at least 15% under 2" size.

E. Embankment Design: The following are recommended:

1. Selectively place the finer and most plastic material like 62W603, the spillway borrow, in trench backfill and a central core. Use the material from Borrow "B", 62W604 in the shells.

2. Place all material at a density to equal 95% of Standard with rock corrections as needed. Control moisture from one point below optimum to 3 points above.

3. Embankment Slopes:

Upstream: 4:1 with a 30' berm at elevation 830.0.

Downstream: 3:1 with a drain at c/b = 0.6.

4. Provide an overfill of 2.5' above the maximum section to compensate for 0.5' residual settlement in the foundation and 2.0' in the embankment itself.

Prepared by:

Attachments

Roland B. Phillips

cc: T. R. Wire
H. M. Mentz, Upper Darby, Pennsylvania
H. Paul Tedrow, Storrs, Connecticut
W. M. Brown, Storrs, Connecticut

CONN. BLACKBERRY RIVER W.S.

DTB JUNE 60 WTF V2 6/61 SITE 15

HYDROGRAPH COMPUTATIONS FOR AUG 1955 STORM 6 25

FROM WPP 7/2/58

SUB-WATERSHED I-B

AREA – 4.22 MI^2 T_C = 3.2 HOURS

III CURVE NO. – 85 T_P = .5 + 1.95 = 2.5 HOURS

POINT RAINFALL – 8.51" T_B = 2.67 x 2.5 = 6.7 HOURS

q_u = 483 x 4.22 / 2.5 = 815 CFS

TIME	RATIO	ACCUM P	ACCUM Q	ΔQ	Qp	Ts	Tp	TB
0	0	0	0					
				0	0	0	2.5	6.7
1	.03	.26	0					
				.02	16	1	3.5	7.7
2	.068	.58	.02					
				.13	106	2	4.5	8.7
3	.110	.93	.15					
				.30	245	3	5.5	9.7
4	.176	1.50	.45					
				.98	799	4	6.5	10.7
5	.330	2.81	1.43					
				2.16	1760	5	7.5	11.7
6	.615	5.23	3.59					
				.68	554	6	8.5	12.7
7	.700	5.96	4.27					
				.55	448	7	9.5	13.7
8	.768	6.54	4.82					
				.42	342	8	10.5	14.7
9	.820	6.98	5.24					
				.35	285	9	11.5	15.7
10	.863	7.34	5.59					
				.30	245	10	12.5	16.7
11	.900	7.66	5.89					
				.29	236	11	13.5	17.7
12	.935	7.96	6.18					
				.28	228	12"	14.5	18.7
13	.970	8.25	6.46					
				.25	204	13	15.5	19.7
14	1.000	8.51	6.71					

CONN BLACKBERRY RIVER W.S.
DTB JUNE 60 WTF V⅛ 6/61 SITE 15

HYDROGRAPH COMPUTATIONS FOR AUG 1955 STORM 7 25
FROM WPP 7/2/58

SUB-WATERSHED II-A — T_c = 1.4 HOURS

AREA — 1.67 MI^2 — T_p = .5 + .84 = 1.4 HOURS

III CURVE NO. — 83 — T_B = 2.67 × 1.4 = 3.7 HOURS

POINT RAINFALL — 8.51" — $q_x = \frac{484 \times 1.67}{1.4}$ = 576 CFS

TIME	RATIO	ACCUM P	ACCUM Q	ΔQ	Q_p	T_s	T_p	T_B
0	0	0	0	0	0	0	1.4	3.7
1	.03	.26	0	.02	12	1	2.4	4.7
2	.068	.58	.02	.08	46	2	3.4	5.7
3	.110	.93	.10	.28	161	3	4.4	6.7
4	.176	1.50	.38	.92	530	4	5.4	7.7
5	.330	2.81	1.30	2.08	1198	5	6.4	8.7
6	.615	5.23	3.38	.67	386	6	7.4	9.7
7	.700	5.96	4.05	.54	311	7	8.4	10.7
8	.768	6.54	4.59	.41	236	8	9.4	11.7
9	.820	6.98	5.00	.35	202	9	10.4	12.7
10	.863	7.34	5.35	.30	173	10	11.4	13.7
11	.900	7.66	5.65	.29	167	11	12.4	14.7
12	.935	7.96	5.94	.28	161	12	13.4	15.7
13	.970	8.25	6.22	.24	138	13	14.4	16.7
14	1.000	8.51	6.46					

CONN BLACKBERRY RIVER W.S.

DTB JUNE 60 WTF 6/61 SITE IS 8 25

HYDROGRAPH COMPUTATIONS FOR AUG 1955 STORM

FROM WPP 7/2/58

SUB-WATERSHED II-B $T_c = 2.7$

AREA - 3.77 MI^2 $T_p = .5 + 1.62 = 2.10$

III CURVE NO - 83 $T_B = 2.67 \times 2.1 = 5.6$

POINT RAINFALL - 8.51" $q_x = \frac{484 \times 3.77}{2.1} = 867$ CFS

TIME	RATIO	ACCUM P	ACCUM Q	ΔQ	Qp	Ts	Tp	TB
0	0	0	0	0	0	0	2.1	5.6
1	.03	.26	0	.02	17	1	3.1	6.6
2	.068	.58	.02	.08	69	2	4.1	7.6
3	.110	.93	.10	.28	243	3	5.1	8.6
4	.176	1.50	.38	.92	798	4	6.1	9.6
5	.330	2.81	1.30	2.08	1803	5	7.1	10.6
6	.615	5.23	3.38	.67	581	6	8.1	11.6
7	.700	5.96	4.05	.54	468	7	9.1	12.6
8	.768	6.54	4.59	.41	355	8	10.1	13.6
9	.820	6.98	5.00	.35	303	9	11.1	14.6
10	.863	7.34	5.35	.30	260	10	12.1	15.6
11	.900	7.66	5.65	.29	251	11	13.1	16.6
12	.935	7.96	5.94	.28	243	12	14.1	17.6
13	.970	8.25	6.22	.24	208	13	15.1	18.6
14	1.000	8.51	6.46					

CONNECTICUT — BLACKSTONE RIVER WATERSHED

10 FEB 61 DTB 13 FEB 61 — SHEET 15

ACCUMULATIVE INFLOW HYDROGRAPH FOR SITE # 15 — 9 — 25

Diane Storm 1955 – To Set Emerg. Spwy. Crest

TIME HRS	I-B + SITE #1 PIPE MODIFIED	II-A OUTFLOW MODIFIED	II-B INFLOW AT SITE # 15	TOTAL INFLOW HYDROGRAPH SITE #15
0	0	0	0	0
1	0	0	0	0
2	5	3	7	15
3	50	31	58	139
4	130	130	225	485
5	390	405	725	1520
6	965	910	1823	3698
7.0	1740	1425	2725	5890
7.1	1835	1400	2815	6050
8.0	2587	1233	2525	6345
9.0	2675	885	1980	5540
10	2435	625	1365	4425
11	2035	480	1025	3540
12	1610	400	840	2850
13	1300	357	750	2407
14	1115	315	680	2110
15	980	240	535	1755
16	810	130	310	1250
17	610	35	135	780
18	435	10	35	479
18.6	360	0	0	360
19.0	310			310
20	207			207
21	177			177
22	151			151

Conn. Blackberry River W.S.

WTF 8/7/61 Site #15

Emergency Spillway Hydrograph Computations (Design High Water) 10 25

Drainage Area .966 Sq.Mi T_c = 4.2 Hrs Runoff Condition III

Runoff Curve No 84 Storm Distrib Curve B Hydrograph Family No. 1

Storm Duration 6 Hrs Rainfall: Point 15.0 in Areal 12.97 in. 86%0

Q = 10.94 in. ~~(Total Rain)~~ Computed T_p = 2.94 Hrs. T_o = 5.56 Hrs.

T_o/T_p = 1.89 Used 2.0 Revised T_p = 2.78 Hrs.

$q_r = \frac{484\ A}{Rev.\ T_p} = \frac{484 \times 9.66}{2.78} = 1682$ cfs $Q q_r$ 10.94 × 1682 = 18,401 cfs

Line No.	t Hrs	q cfs	Line No.	t Hrs	q cfs
1	0	0	16	12.09	772
2	.81	129	17	12.90	515
3	1.61	644	18	13.71	313
4	2.42	3020	19	14.51	202
5	3.22	7950	20	15.31	129
6	4.03	12300	21	16.12	74
7	4.84	13620	22	16.93	37
8	5.64	12510	23	17.73	18
9	6.45	10310	24	18.54	0
10	7.26	8110			
11	8.06	5870			
12	8.87	3900			
13	9.68	2575			
14	10.48	1730			
15	11.29	1160			

CONN — BLACKBERRY RIVER WS.

DTB. 3 FEB 61 WTF 8 Feb 61 SITE NO. 15

FREE BOARD HYDRO GRAPH 11 25

DR. AREA: 9.66 mi^2 T_c = 4.2 Hrs RUNOFF COND. II CURVE NO. 66

STORM DIST CURVE B 2.5 x PT. RAINFALL = 25 INCHES

MOD. FACTOR: 0.867 MODIFIED PRECIP = 25 x .867 = 21.7 = AREAL RAINFALL

Q = 16.56" HYDROGRAPH FAMILY NO. 2 STORM DURATION: 6 HOURS

T_p = .7 T_c = 2.94 HOURS T_o = 5.35 HOURS T_o/T_p = 1.82 ; USE 2

REVISED T_p = 2.68 HYDROGRAPH COORDINATE SHEET 3.21-46

$$q_p = \frac{484 \times 9.66}{2.68} = 1747 \text{ CFS}; \quad Q_{q_p} = 1747 \times 16.56 = 28{,}925 \text{ CFS}$$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	14	9.75	3,269
2	.75	115.8	15	10.50	2,170
3	1.50	1,158	16	11.25	1,448
4	2.25	4,920	17	12.00	984
5	3.01	12,400	18	12.75	608
6	3.76	18,650	19	13.51	405
7	4.51	20,680	20	14.25	231
8	5.26	19,580	21	15.01	115.8
9	6.01	16,600	22	15.77	86.9
10	6.76	13,640	23	16.51	57.9
11	7.51	10,675	24	17.27	28.9
12	8.25	7,150	25	18.00	0
13	9.01	4,965			

SLIDE RULE ACCURACY

$$Q = \frac{(\Delta T)(\Sigma q)}{645 A}$$

$$Q = \frac{.7504 (13{,}939.3)}{645 (9.66)}$$

$Q = 16.84$

$$\text{ERROR} = \frac{.28}{16.56} \times 100 = 1.69\% \text{ OK}$$

OK J. Simon 3/27/63

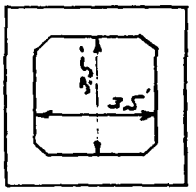
CONN. BLACKBERRY RIVER W.S.

W.T.F. 3-8-61 D.T.B. 6-12-61 SITE #15

12 25

FLOW CONSTANTS - PRINCIPAL SPILLWAY

PRINC SPWY CONDUIT: 3.5' x 3.5' SQUARE CONDUIT, ~~X~~ 12"
CHAMFERED CORNERS



RISER: RECTANGULAR, INSIDE DIMENSIONS 3.5' x 10.5'
2 ENTRANCES, rounded weir
2-STAGE RISER

WEIR FLOW: —

$L_w = 2\left(\frac{9.67}{\cancel{10.5}}\right) = \frac{\cancel{21}'}{19.33}'$

$C_w = 3.4$

$\therefore Q_w = C_w L_w H^{3/2}$

$= 3.4 \left(\frac{19.33}{\cancel{21}}\right) H^{3/2}$

$= \frac{65.72}{\cancel{71.4}} H^{3/2}$

NOTE
USING THE FINAL CONDUIT SECTION WITH FILLETS THE PIPE-FLOW CONSTANT EQUALS: $C_w = 38.88$

PIPE FLOW: —

"n" for both Conduit & Riser = .012

$L_c = \frac{520}{\cancel{375}}'\pm$, $A_c = \cancel{12.03}$ SQ.FT. 10.25 Ft²

$L_R = 8'$, $A_R = 36.75$ SQ. FT.

$K_c = \frac{.00502}{0.00572}$ $K_R = .0024$ ½

$$K_T = \frac{1}{\sqrt{K_o + K_e + K_c L_c + K_R L_R \left(A_c/A_R\right)^2}}$$

Conduit $S = \frac{3}{520} = 0.577\%$

$K_o = 1.0$

$K_c = \cancel{.11}$ " SAF TECH. PAPER No. 18 Sec. B

(0.50) Small Dam Design Bur. Rec. Pg 330.

$$K_T = \frac{1}{\sqrt{1.0 + \underset{0.50}{.11} + \underset{0.00572(520)}{.00502(375)} + .0024\tfrac{1}{2}\left(8\right)\left(\frac{\cancel{12.03}}{36.75}\right)^2}}$$

$$= \frac{1}{\sqrt{1.0 + .11 + \cancel{1.875} + .0018}} = \frac{1}{\sqrt{\underset{0.50}{3.9768}}} = \frac{1}{\underset{4.4754}{\cancel{1.994}}} = \underset{2.116}{}$$

$K_T = \frac{0.473}{\cancel{.502}}$ / 0.455

$\therefore Q_p = K_T A_c \sqrt{2g H_p} = \underset{0.473}{.502}(\cancel{12.03}) \underset{10.25}{0.02} H_p^{1/2} = (\cancel{406}) H_p^{1/2}$

$\underset{38.88}{}$

Sheet 13 of 25 — RZH. 62 R.J. ✓

CONN. — BLACKBERRY RIVER W.S.

STAGE DISCHARGE COMPUTATIONS.

EL. OF ℄ PIPE OUTLET = 801.75
CREST OF RISER = 811.00
CREST OF EM. SPWAY = 871.30

PIPE FLOW $Q = 38.88\ H^{1/2}$

EL.	H	$H^{1/2}$	Q_P CFS
811.0	—	—	—
813.0	11.25	3.35	130
820.0	18.25	4.27	166
830.0	28.25	5.31	206
840.0	38.25	6.18	240
850.0	48.25	6.95	270
860.0	58.25	7.63	297
8700	68.25	8.26	321
875.0	73.25	8.56	333

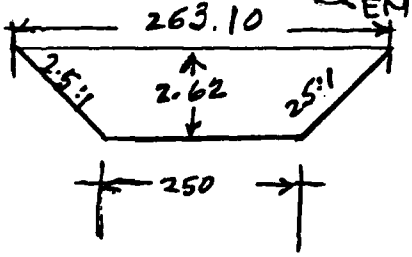
EMERG. SPILLWAY FLOW. $n = 0.04$

ELEVATION	Q_P	Q_E	$Q = Q_P + Q_E$
871.30	324	0	324
873.19	328	1262	1590
874.06	331	2537	2868
874.78	332	3823	4155
875.40	334	5117	5451
876.50	337	7728	8065
877.65	338	10370	16708

DESIGN HIGH WATER : 875.80 } AFTER FLOOD ROUTING.
$Q_{MAX} = 6400$ CFS

$Q_P = 38.88 \times 74.05^{1/2} = 335$ CFS.

$Q_{EMAX} = Q_{MAX} - Q_{PIPE} = 6400 - 335 = 6065$ CFS.



$d_c = 2.62$ F (USING EQ 24)

$A = 672.2$ F²

$z/b = \frac{2.5}{250} = 0.01$

$Q_c/b = \frac{6065}{250} = 24.26$

$V_{MAX} = \frac{6065}{672.2} = 9.02$ F/SEC.

COMPUTATION SHEET
SCS-522 REV 5-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

GPO 1958 O-470668

STATE		PROJECT		
Connecticut		Blackberry River, Site #15		
BY	DATE	CHECKED BY	DATE	JOB NO.
E	2/14/64	JRD		CN-413-H

SUBJECT: Emergency Spillway Discharge — SHEET 13a OF

Design High Water Discharge 6065 c.f.s. = Q

d_c (ES-24) = 2.62'

A = 672.2 Ft²

$Z/b = 2.5/250 = 0.01$

$Q_c = 0.25Q$ (Refer Memo. #27)

$Q_c = 0.25(6065) = 1516$ c.f.s.

$Q_c/b = 1516/250 = 6.07$ c.f.s./Ft. width

$Q/b = \frac{6065}{250} = 24.26$ c.f.s./Ft.

V_c = 5.8 Ft./sec. (ES-98 1 of 4)

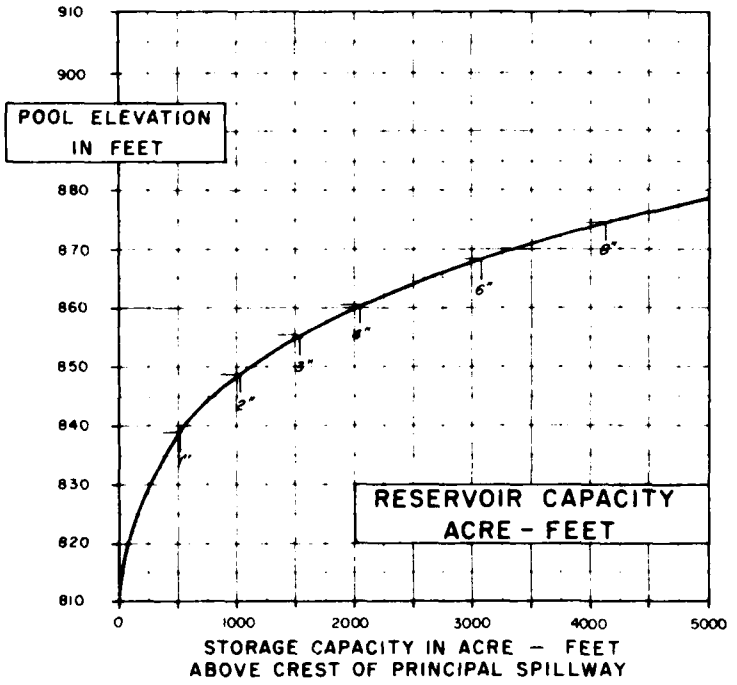
V_c = 9.0 Ft./sec. (ES-98 1 of 4) For Max. Design High Water Discharge

S_c = 1.29% (ES-98 3 of 4 n = 0.030)

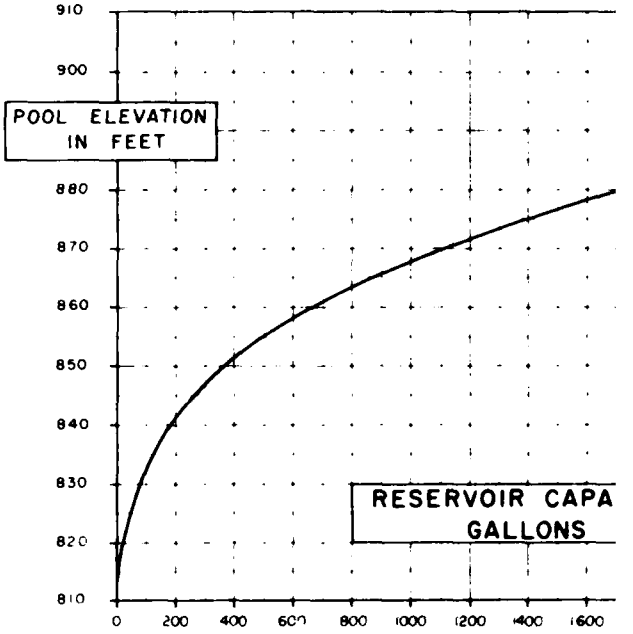
S_c = 1.29% is less than the 1.75% slope used in the emergency spillway. We therefore have supercritical flow from 6% to 100% of design high water discharge.

RESERVOIR OPERA

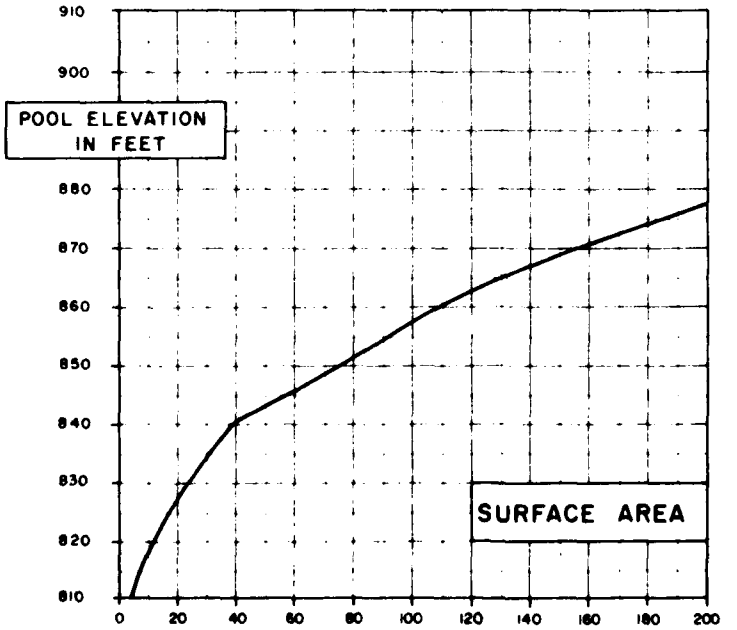
SITE NO. 15 - WHITING RIVER RESERVOIR - WHITING



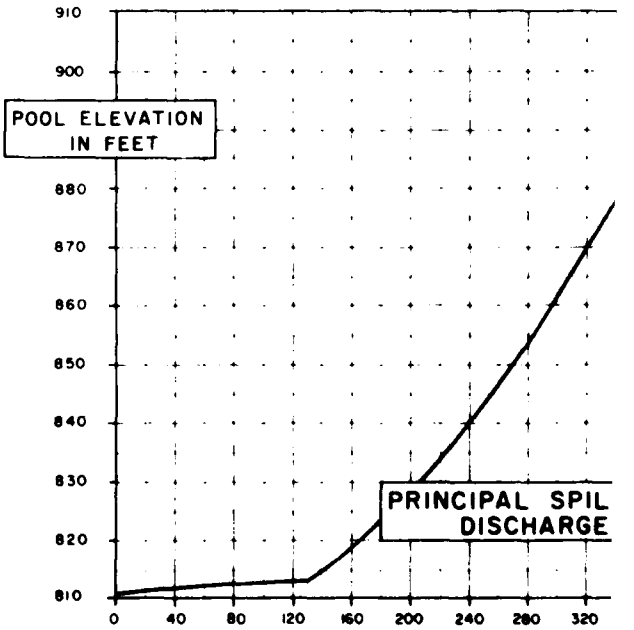
STORAGE CAPACITY IN ACRE - FEET
ABOVE CREST OF PRINCIPAL SPILLWAY



MILLIONS OF U.S GALLONS



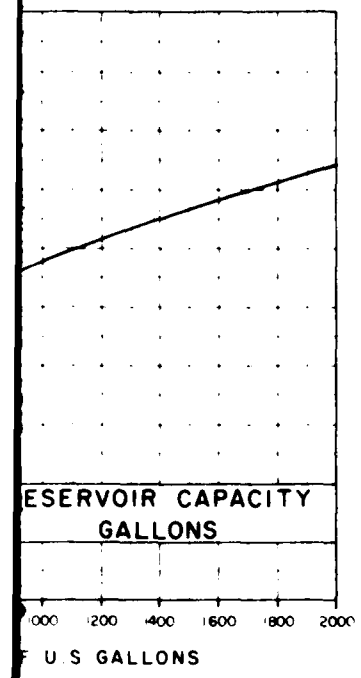
SURFACE AREA IN ACRES
ABOVE LOW POINT OF RESERVOIR

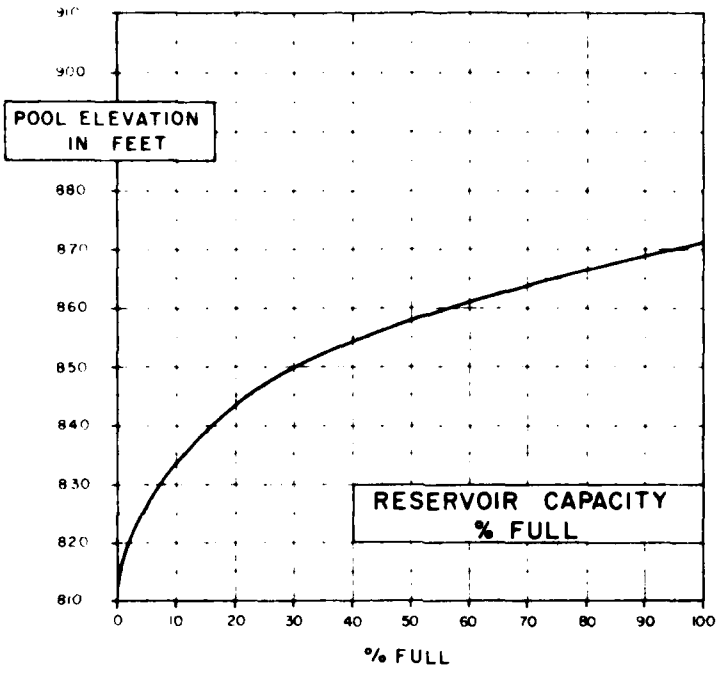


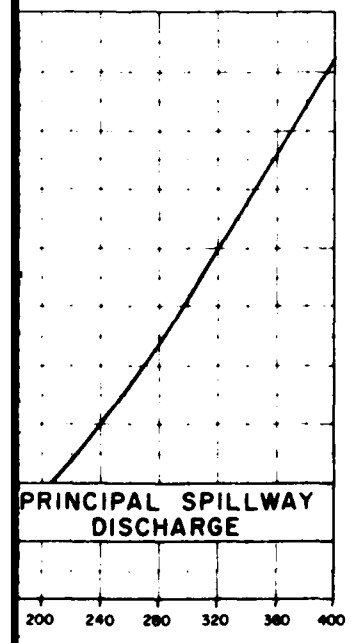
DISCHARGE IN CUBIC FEET PER SECOI

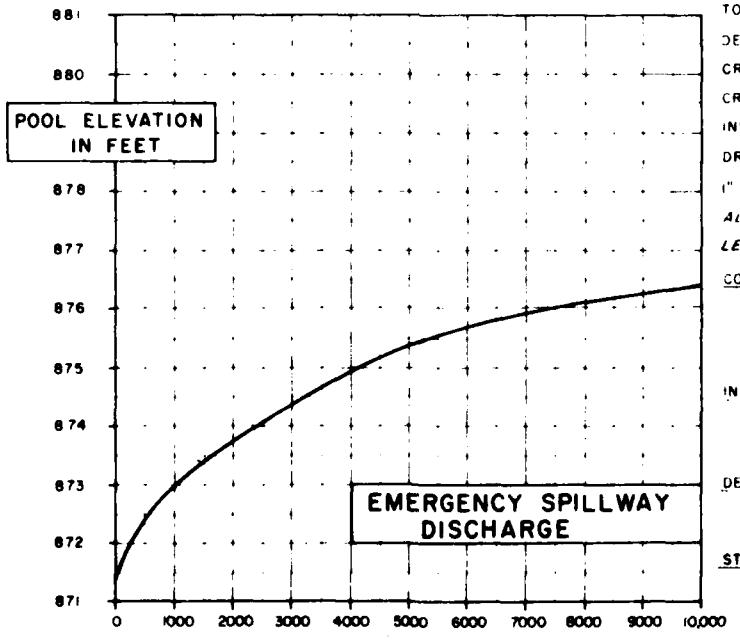
OPERATION DATA

- WHITING RIVER - BLACKBERRY RIVER WATERSHED









PERTINENT DATA

TOP OF DAM	EL 878.6
DESIGN HIGH WATER	EL 875.8
CREST EMERGENCY SPILLWAY	EL 871.3
CREST PRINCIPAL SPILLWAY	EL 811.0
INVERT LOW FLOW ORIFICE	EL 803.5
DRAINAGE AREA CONTROLLED	9.66 SQ MI
1" OF RUNOFF = 515.17 ACRE-FEET	

ALL ELEVATIONS REFER TO MEAN SEA LEVEL DATUM

CONSTRUCTED BY
STATE OF CONNECTICUT
DEPARTMENT OF AGRICULTURE & NATURAL RESOURCES
JOSEPH N. GILL, COMMISSIONER

IN ASSOCIATION WITH THE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PUBLIC LAW 566 FUNDS

DESIGNED BY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATUS
COMPLETED DECEMBER 22, 1966

Anderson-Nichols Associates February 1967

2

Mansfield Professional Park, Storrs, Connecticut 06268

July 20, 1977

Victor F. Galgowski
Superintendent of Dam Maintenance
Water Resources Unit
Department of Environmental Protection
State Office Building
Hartford, CT 06115

Dear Mr. Galgowski:

As a result of our inspection of Blackberry Sites 15 and Site 6 on July 14, 1977, the following observations and recommendations are made:

1. Blackberry Site 15, Whiting River Site:

The SAF outlet area was pumped down sufficiently to observe the 8" C.M.P. drainage pipes and to allow excavation behind both wingwalls in the vicinity of the wingwall waterstops. Both waterstops were in good condition, except for the top few inches as previously reported. There seems to be no cause for concern at this point, since the waterstops can stretch a good deal more before failure. The sinkhole behind the right wingwall occurred because drain fill had piped through the square opening formed around the 8" drain pipe. Piping now appears to have stopped.

Recommended Actions:

1. Fill the cracks behind the waterstops to about 2' below ground surface with joint filler (trowel consistency) to protect the waterstop from damage. (DEP).

2. Fill the area behind both wingwalls with clean gravel to bring the area level with the surrounding fill. (DEP).

Not done 3. Place marks on wingwalls to take further measurements in the future. (SCS). Fine chisel marks or small diameter drill holes in the concrete would be satisfactory.

We also went inside the principal spillway conduit and took measurements at each joint. All joints were in excellent condition and no seepage was observed. Two fine cracks were observed in the concrete;

one upstream from joint J-16, and one downstream from J-16. No seepage was observed from the cracks. The concrete in general looked in very good condition with no spalling or wearing observed.

Recommended Actions:

1. Periodic measurements (once every 5-10 years) to be taken on pipe joints and cracks (SCS and DEP).

2. Blackberry Site 6, Norfolk Brook Site:

The plunge pool area had enlarged to the point where debris had built up in the outlet channel. Water was backed up into the 30" principal spillway conduit to a depth of about 1'. The drainage system C.M. pipes were completely submerged.

Recommended Actions:

1. Clean out the debris buildup and excavate the outlet channel so that no water backs into the principal spillway conduit. Place the larger stones on the side of the plunge pool where active erosion is taking place. (DEP).

2. Insure the drainage system pipes are cleared by running small pipes or rods up the last 20' - 30' of outlet pipe. Sometimes algae buildup can block the outlet pipes. (DEP).

I thank you and the people from the maintenance section for your assistance in the inspection. Please keep us informed of actions taken, and feel free to ask for our assistance any time.

Whitney T. Ferguson, Jr.
State Conservation Engineer

cc: D. M. McArthur, Storrs
J. Polulech, Storrs ✓
A. Cross, D.C., Litchfield

WATER RESOURCES UNIT - D.E.P.

OPERATION AND MAINTENANCE INSPECTION REPORT

PROJECT: North Canaan - Site 15 DATE: August 13, 1979

INSPECTION PARTY: A. Cross, Soil Conservation Service; and A. Roberts, V. Galgowski, Department of Environmental Protection

ITEM	CONDITION S or U*	MAINTENANCE OR REPAIRS REQUIRED	DATE COMPLETED
I. Embankments			
A. Vegetation	S		
B. Rip rap	S		
C. Drains	S		
II. Principal Spillway			
A. Trash rack	S		
B. Gates	S		
C. Stilling basin	S		
D. Conduit	S		
III. Emergency Spillway			
A. Vegetation	S		
B. Obstructions	S		
IV. Outlet Channels			
A. Slope protection	S		
B. Debris	S		
V. Reservoir Area			
A. Debris	S		
B. Stop logs	N/A		
VI. Miscellaneous			
A. Access road	S		
B. Fences	S		

Remarks: Site in very good condition.

Brush growth along outlet channel sprayed with herbicide.

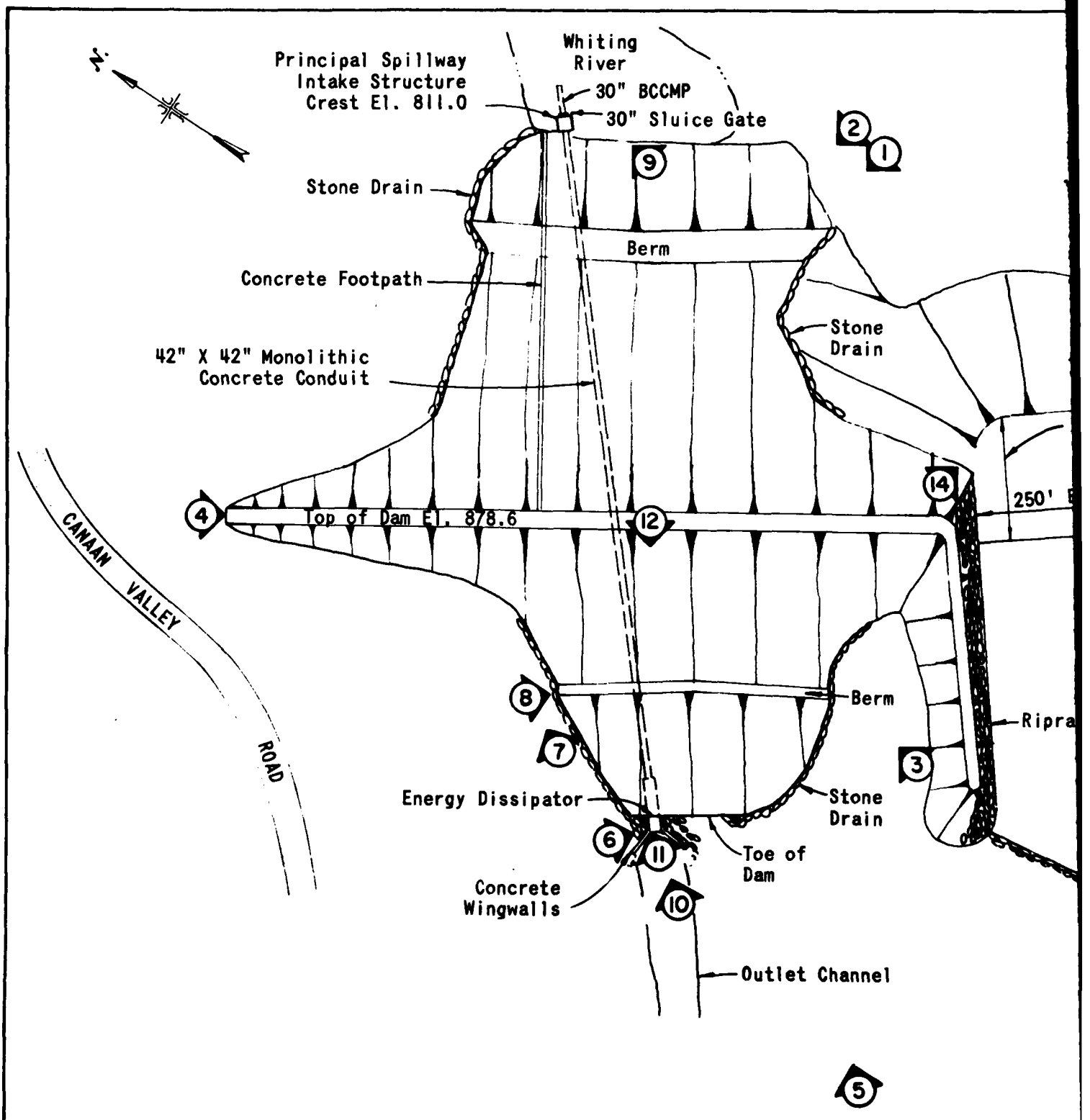
Temporary wooden cover on riser will eventually need to be replaced with steel plate.

Inspected by: Victor F. Galgowski Title Supt. of Dam Maintenance

* S = Satisfactory
U = Unsatisfactory
NA = Not applicable

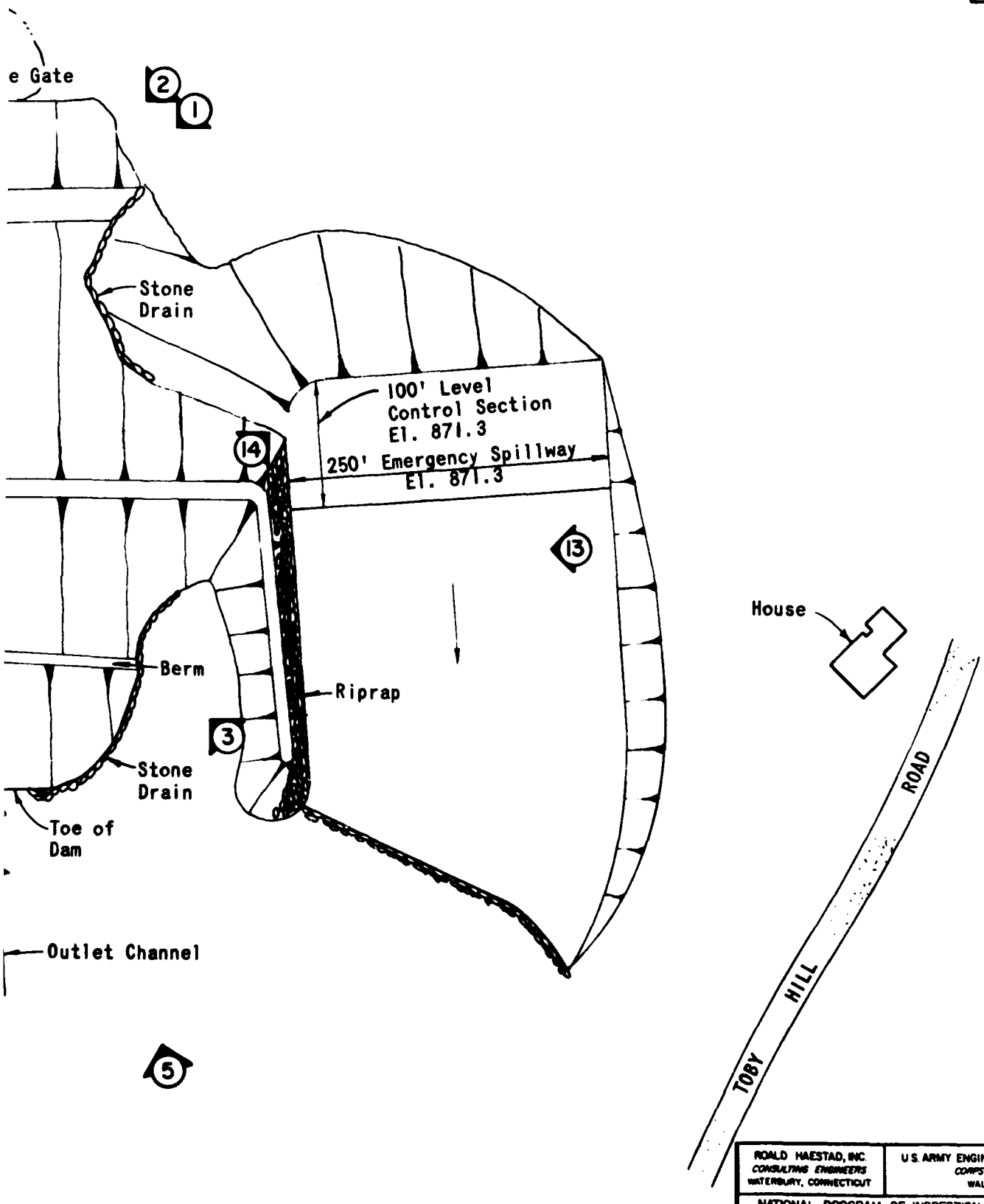
APPENDIX C

PHOTOGRAPHS



Denotes photo number and direction in which photo was taken.

FIGURE 2



ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PHOTO LOCATION PLAN
WHITING RIVER DAM
NORTH CANAAN, CONNECTICUT

DRAWN	CHECKED	APPROVED	SCALES	DATE	PAGE
JRS	RGL	RH	1" = 100'	2/81	C-1

PHOTO NOS. 1 AND 2

UPSTREAM SLOPE. NOTE BERM, STONE DRAINS AND PRINCIPAL SPILLWAY.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80

PHOTO NO. 3

DOWNSTREAM SLOPE. NOTE STONE DRAINS AND BERM.

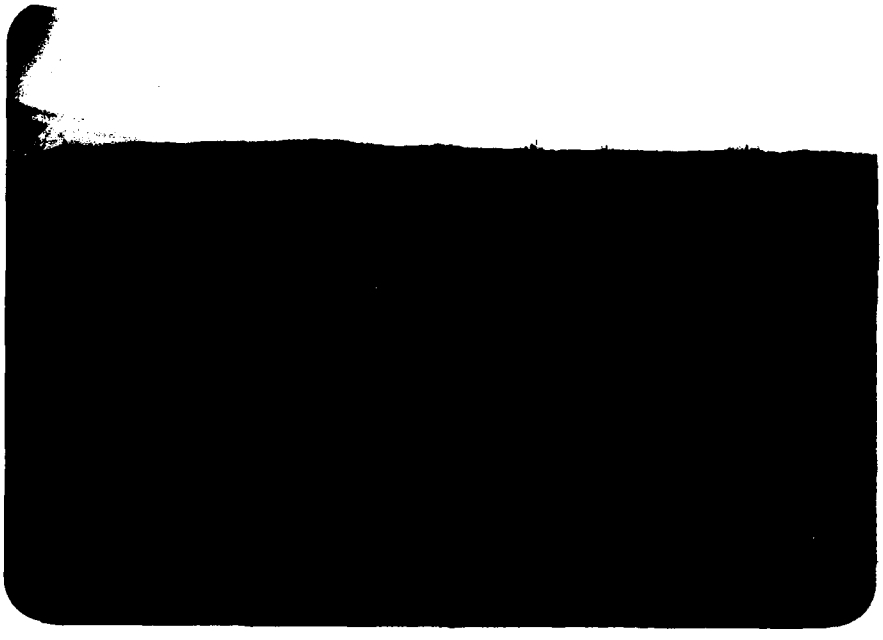


PHOTO NO. 4

CREST FROM RIGHT ABUTMENT. NOTE EMBANKMENT SEPARATING DAM FROM EMERGENCY SPILLWAY IN BACKGROUND.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 5

DOWNSTREAM SLOPE. NOTE MOTORCYCLE PATHS.

PHOTO NO. 6

LEFT ABUTMENT. NOTE MOTORCYCLE PATH AND EMBANKMENT SEPARATING DAM FROM EMERGENCY SPILLWAY.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 7

STONE DRAIN AT
RIGHT ABUTMENT,
DOWNSTREAM SLOPE.
NOTE STEEP LEDGE OUTCROP
AT ABUTMENT.

PHOTO NO. 8

DEPRESSION OF
STONE DRAIN AT
RIGHT ABUTMENT,
DOWNSTREAM SLOPE

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

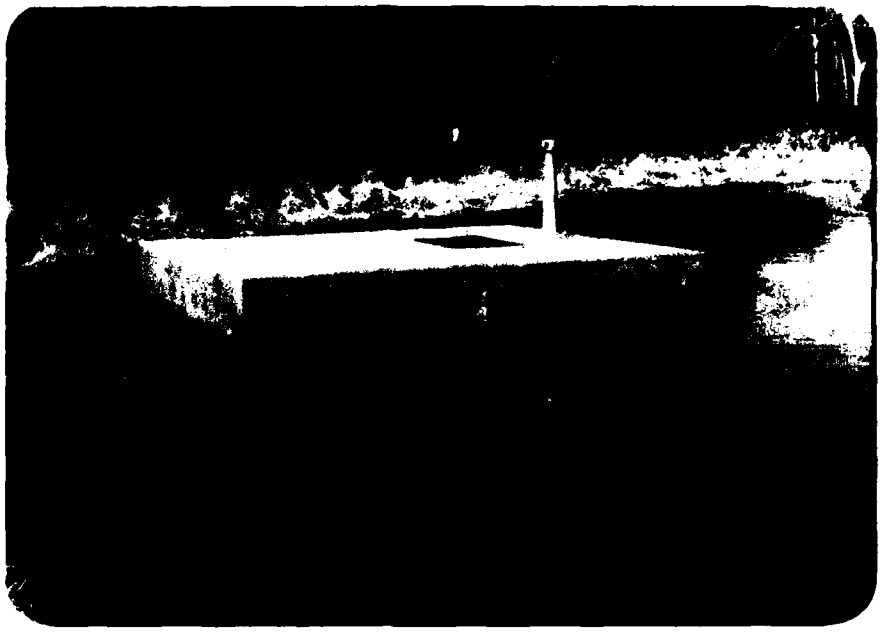


PHOTO NO. 9

PRINCIPAL SPILLWAY STRUCTURE. NOTE SLOPING PIPE OF TRASH RACK, SLUICE GATE OPERATOR, AND WATER SURROUNDING STRUCTURE.

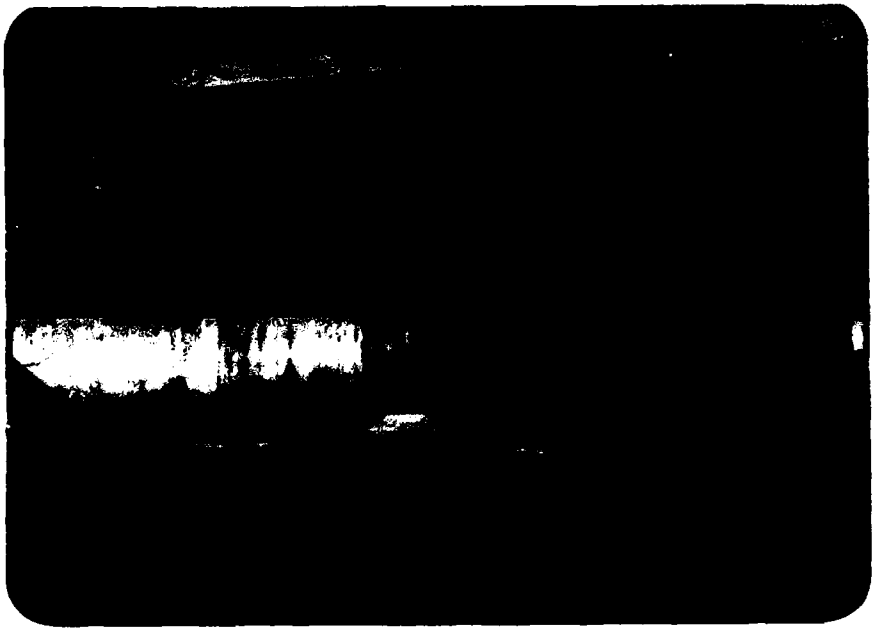


PHOTO NO. 10

OUTLET STRUCTURE AT DOWNSTREAM TOE.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

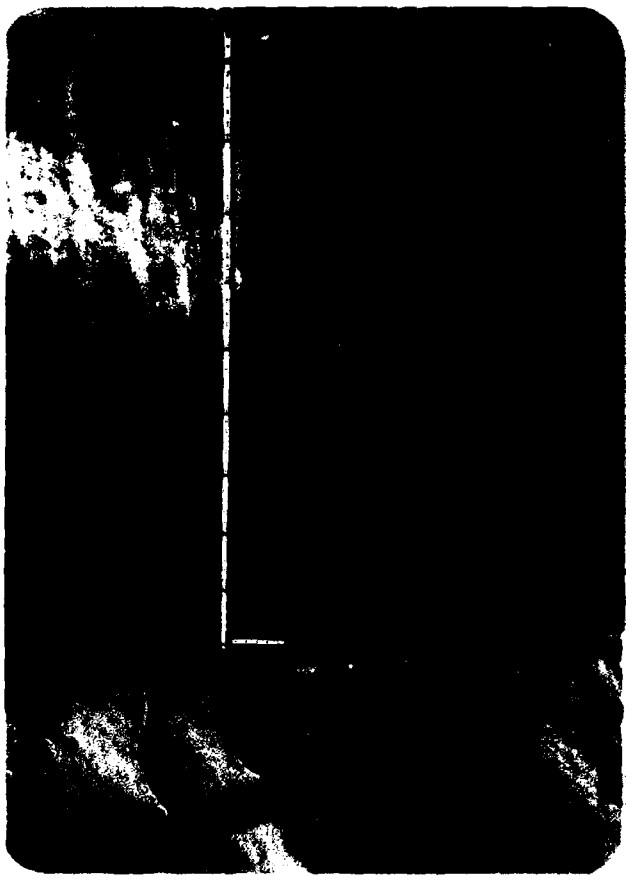


PHOTO NO. 11

CONSTRUCTION JOINT AT RIGHT TRAINING WALL. JOINT OPEN 1-1/2" AT WATERLINE.

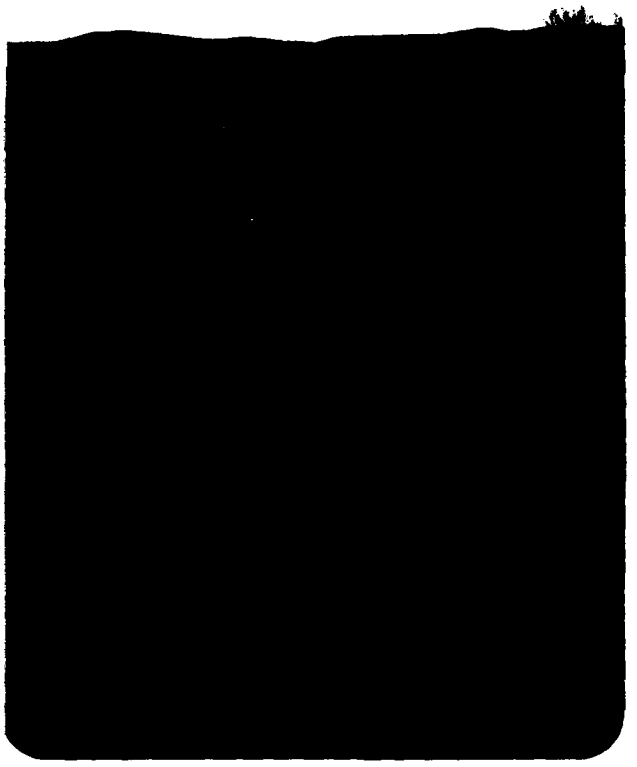


PHOTO NO. 12

DOWNSTREAM CHANNEL.

U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

PHOTO NO. 13

EMBANKMENT BETWEEN EMERGENCY SPILLWAY
AND DAM. NOTE RIPRAP ON SLOPE.

PHOTO NO. 14

APPROACH CHANNEL AND CONTROL SECTION OF EMERGENCY SPILLWAY.
NOTE BASES OF BALLFIELD AND DIFFERENCE IN LENGTHS OF GRASS.

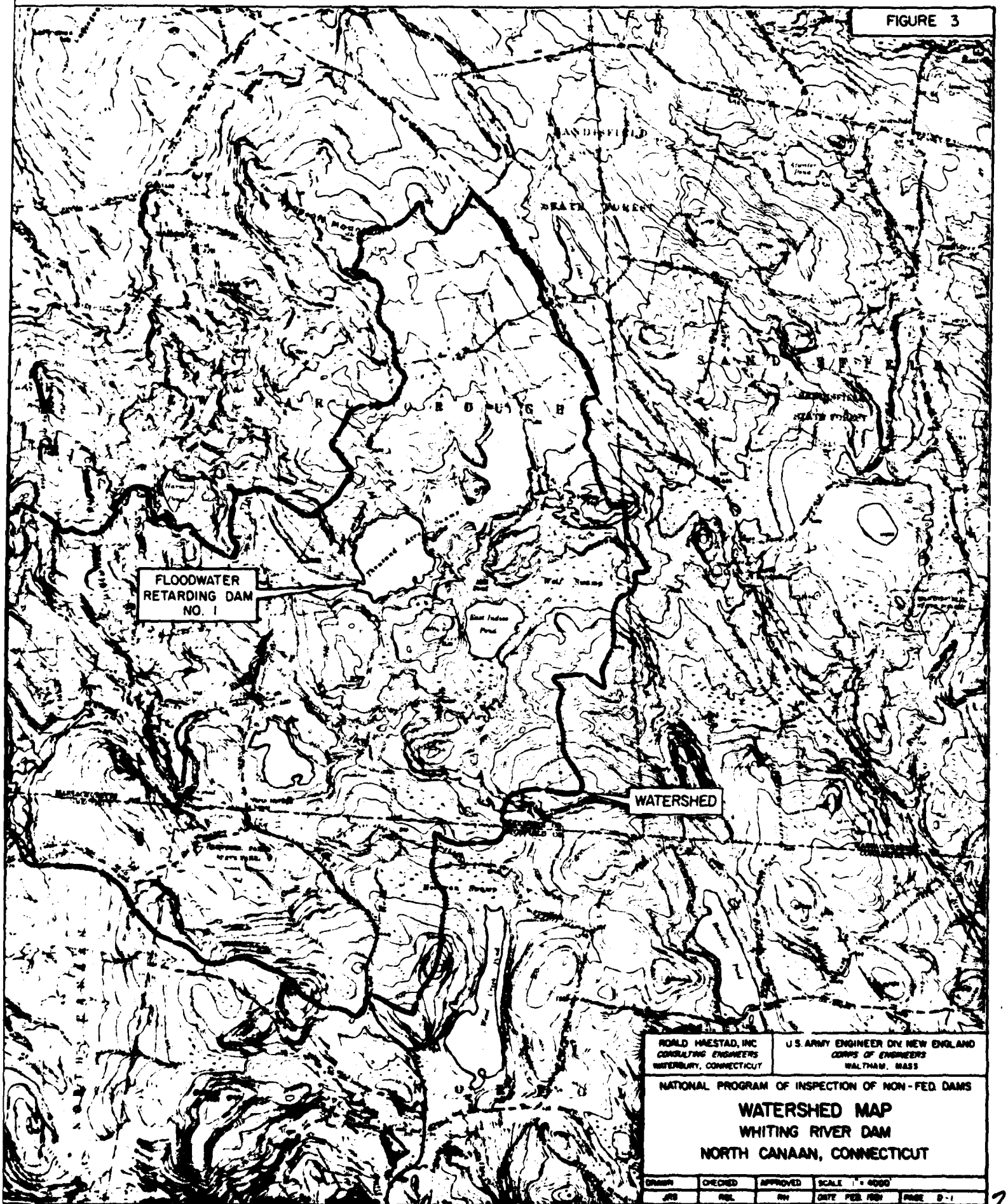
U.S.ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	WHITING RIVER DAM WHITING RIVER NO. CANAAN, CONNECTICUT CT 00483 17 NOV '80
ROALD HAESTAD, INC. CONSULTING ENGINEERS WATERBURY, CONNECTICUT		

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS


N.
FLOODWATER
RETARDING DAM
NO. 1
WHITING RIVER
DAM

FIGURE 3



ROALD HAESTAD, INC.
CONSULTING ENGINEERS
WATERBURY, CONNECTICUT

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

WATERSHED MAP
WHITING RIVER DAM
NORTH CANAAN, CONNECTICUT

DRAWN	CHECKED	APPROVED	SCALE 1" = 4000'	
JRB	RBL	RH	DATE FEB. 1981	PAGE D-1

2

BY DLS DATE 1/16/81 **ROALD HAESTAD, INC.** SHEET NO 1 OF 17

CONSULTING ENGINEERS

CKD BY SAL DATE 1/19/81 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 42-034

SUBJECT WHITING RIVER DAM - NO. 15 EMERGENCY SPILLWAY CAPACITY

EL 871.3 b = 250' L = 100' Z = 2.25 n = 0.030 ES-124 Sheet 1

q_c cfs/ft	d_c ft	V_c fps	Zd_c	$W = b + Zd_c$	$Q_c = q_c W$	H_p	W.S. ELEV.	CONDUIT H. ft.	CONDUIT Q cfs	COMB Q cfs
	0.315	3.2	0.71	250.71	251	0.81	872.11	70.36	326	577
3	0.66	4.6	1.49	251.49	754	1.32	872.62	70.87	327	1081
5	0.92	5.4	2.07	252.07	1260	1.67	872.97	71.22	328	1588
10	1.47	6.8	3.31	253.31	2533	2.52	873.82	72.07	330	2863
15	1.92	7.8	4.32	254.32	3815	3.22	874.52	72.77	332	4147
20	2.34	8.6	5.27	255.27	5105	3.84	875.14	73.39	333	5438
25	2.70	9.3	6.08	256.08	6402	4.37	875.67	73.92	334	6736
30	3.05	9.9	6.86	256.86	7706	4.94	876.24	74.49	336	8042
40	3.70	10.9	8.33	258.33	10,333	5.88	877.18	75.43	338	10,671
50	4.30	11.7	9.68	259.68	12,984	6.79	878.09	76.34	340	13,324

FLOW OVER CREST OF DAM - 580' @ EL 878.6

$Q = CLH^{3/2}$ $C = 2.7$

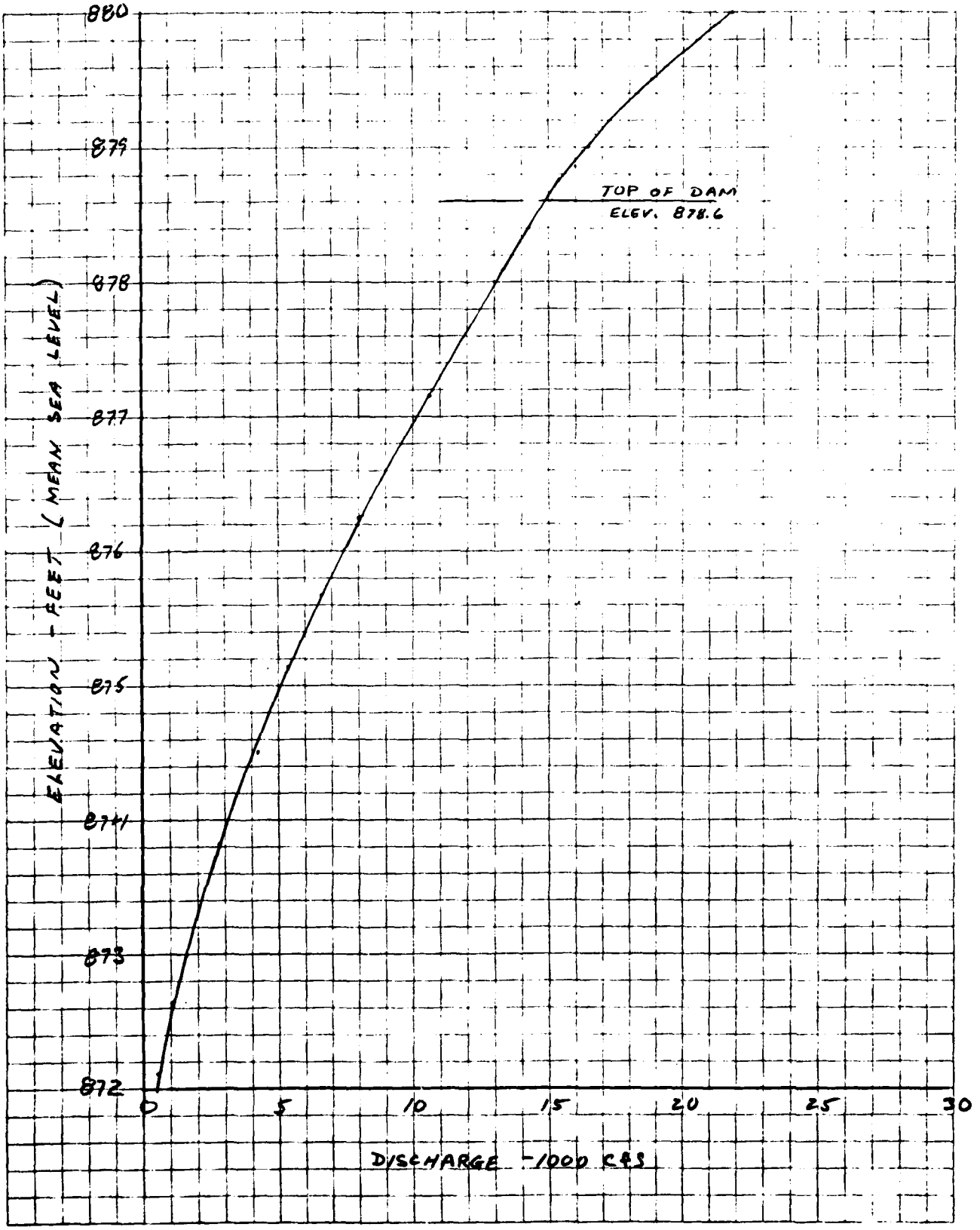
ELEV.	Q (cfs)
879.0	396
879.5	1337
880.0	2594
880.5	4100

BY D.A.S. DATE 1/7/81 **ROALD HAESTAD, INC.** SHEET NO 2 OF 17

CONSULTING ENGINEERS

CKD BY SAL DATE 1/19/81 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 42:034

SUBJECT WHITING RIVER DAM - NO. 15 DISCHARGE CAPACITY



CONN. BLACKBERRY RIVER W.S. CH-4.5-4

D.T.B. 1-27-61 WTF 6/15/61 SITE 15

Stage - Storage Computations 3 25

3/17

Elev.	Area Ac.	Σ Adjacent Areas	Ave. Area Ac	Vol. Ac-Ft	Σ Vol.	Available Storage
800	0					
		3.85	1.93	19.3		
810	3.85				19.3	At Elev 811.0 Storage = 0
		15.91	7.96	79.6		
820	12.06				98.9	71.7
		35.06	17.53	175.3		
830	23.0				274.2	247.0
		62.3	31.15	311.5		
840	39.3				585.7	558.5
		114.1	57.05	570.5		
850	74.8				1156.2	1129.0
		184.3	92.15	921.5		
860	109.5				2077.7	2050.5
		267.2	133.6	1336		
870	157.7				3413.7	3386.5
		344.0	172	860		
875	186.3				4273.7	4246.5
		410.6	205.3	1026.3		
880	224.3				5300.0	5270.0*

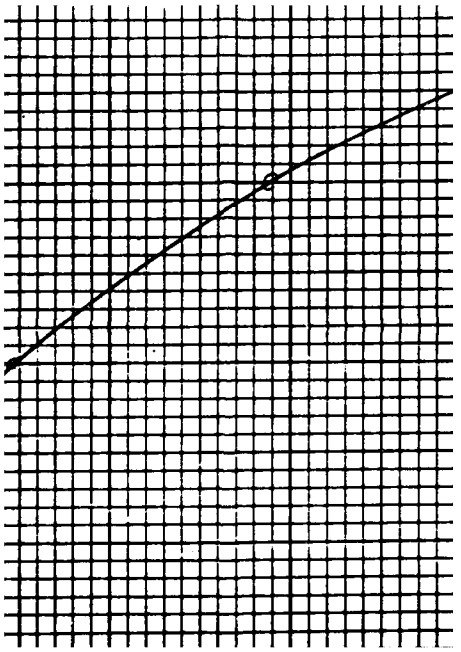
* Extension of S.vs.S. curve

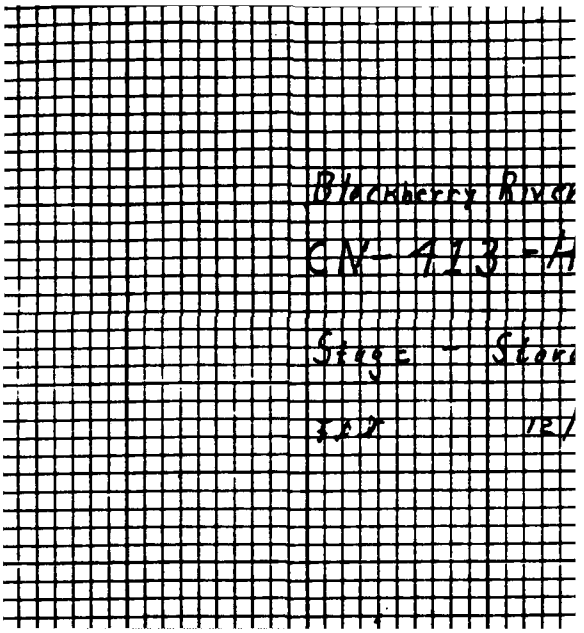
Required Sediment Storage = 26.6 Ac-Ft

At Elev. 811.0, the available storage is

approx. 27.2 Ac-Ft.

Set Crest of Principal Spillway at Elev. 811.0




Blackberry Rive
CN-413-H
Stage - Stor
12/

TEST FLOOD = PMF

DRAINAGE AREA = 14.14 Sq. Mi.

FROM CORPS OF ENGINEERS CHART FOR "MOUNTAINOUS" TERRAIN

MPF = 1850 CFS / sq. mi.

PMF = 1850 x 14.14 = 26,159 CFS

USE 26,000 CFS

Q_{p1} = 26,000 CFS

H_1 = 880.7 $STOR_1$ = 5480 Ac-FT. = 7.3"

$Q_{p2} = Q_{p1}\left(1 - \frac{STOR_1}{19}\right) = 26{,}000\left(1 - \frac{7.3"}{19}\right) = 16{,}010$ CFS

H_2 = 878.9 $STOR_2$ = 5,060 Ac-FT. = 6.7"

$STOR_{AVE.} = \frac{STOR_1 + STOR_2}{2} = \frac{6.7" + 7.3"}{2} = 7.0"$

$Q_{p3} = 26{,}000\left(1 - \frac{7.0}{19}\right) = 16{,}421$ CFS

H_3 = 879.0 $STOR_3$ = 5100 Ac-FT. = 6.8"

$STOR_{AVE.} = \frac{6.7" + 6.8"}{2} = 6.75"$

$Q_{p4} = 26{,}000\left(1 - \frac{6.75"}{19}\right) = 16{,}763$ CFS

Use 16,800 cfs

H_4 = 879.1

OVERTOPS DAM BY 0.5 feet

BY DLS DATE 1/7/81 **ROALD HAESTAD, INC.** SHEET NO 6 OF 17

CONSULTING ENGINEERS

CKD BY SAL DATE 1/19/81 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 419-034

SUBJECT WHITING RIVER DAM - TEST FLOOD

SPILLWAY CAPACITY AT TOP OF DAM

CAPACITY = 14,800 CFS

PMF ROUTED OUTFLOW = 16,800 CFS

$$\text{SPILLWAY} = \frac{14,800}{16,800} \times 100 = \underline{88\%} \text{ of Test Flood}$$

THOUSAND ACRE FLOOD CONTROL DAM IS LOCATED WITHIN WATERSHED AND CONTROLS 4.5 sq. mi. of WATERSHED. THIS SHOULD REDUCE FLOWS SO THAT OVERTOPPING DOES NOT OCCUR.

S = Storage at time of failure = 5,000 Ac-Ft.

Q_{p1} = PEAK FAILURE OUTFLOW = $8/27\ W_b \sqrt{g}\ Y_o^{3/2}$

W_b = Breach Width = 40% of dam length at mid-height

Dam Length at mid-height = 247'

$W_b = 0.4\,(247) = 98.8$ ft.

Y_o = Total height from river bed to pool level at time of failure

Y_o = 80 feet

$$Q_{p1} = 8/27\,(98.8)\sqrt{32.2}\,(80)^{3/2}$$

$Q_{p1} = 118,863$ SAY 119,000 cfs

SUBJECT WHITING RIVER DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 1

TOTAL SECTION

H (FT)	W (FT)	A (SQ-FT)	R (FT)	S (FT/FT)	V (FT/SEC)	Q (CFS)
1.0	43	21	0.50	0.0050	1.32	28
2.0	85	85	1.00	0.0050	2.10	178
3.0	128	191	1.50	0.0050	2.75	526
4.0	170	340	1.99	0.0050	3.33	1132
5.0	213	531	2.49	0.0050	3.86	2053
6.0	256	765	2.99	0.0050	4.36	3338
7.0	298	1041	3.49	0.0050	4.84	5035
8.0	341	1360	3.99	0.0050	5.29	7189
9.0	384	1721	4.49	0.0050	5.72	9842
10.0	426	2125	4.99	0.0050	6.13	13035
11.0	436	2555	5.86	0.0050	6.83	17444
12.0	447	2995	6.71	0.0050	7.47	22386
13.0	457	3445	7.54	0.0050	8.08	27845
14.0	467	3905	8.36	0.0050	8.66	33812
15.0	477	4375	9.17	0.0050	9.21	40279
16.0	487	4855	9.96	0.0050	9.73	47240
17.0	498	5345	10.74	0.0050	10.23	54691
18.0	508	5845	11.51	0.0050	10.71	62628
19.0	518	6355	12.27	0.0050	11.18	71049
20.0	528	6875	13.02	0.0050	11.63	79954
21.0	538	7405	13.75	0.0050	12.06	89336
22.0	549	7945	14.48	0.0050	12.49	99199
23.0	559	8495	15.20	0.0050	12.90	109545
24.0	569	9055	15.91	0.0050	13.29	120375
25.0	579	9625	16.61	0.0050	13.68	131689

MANNING COEFFICIENT=N=0.0500
STORAGE AT TIME OF FAILURE=S= 5000 AC. FT.
LENGTH OF REACH=L= 3000 FT

INFLOW INTO REACH=QP1=119000 CFS
DEPTH OF FLOW=H1= 23.9 FT.
CROSS SECTIONAL AREA=A1= 8984 SQ.FT.
STORAGE IN REACH=V1= 460.5 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)=108040 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 22.9 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 8415 SQ.FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 421.3 AC. FT.

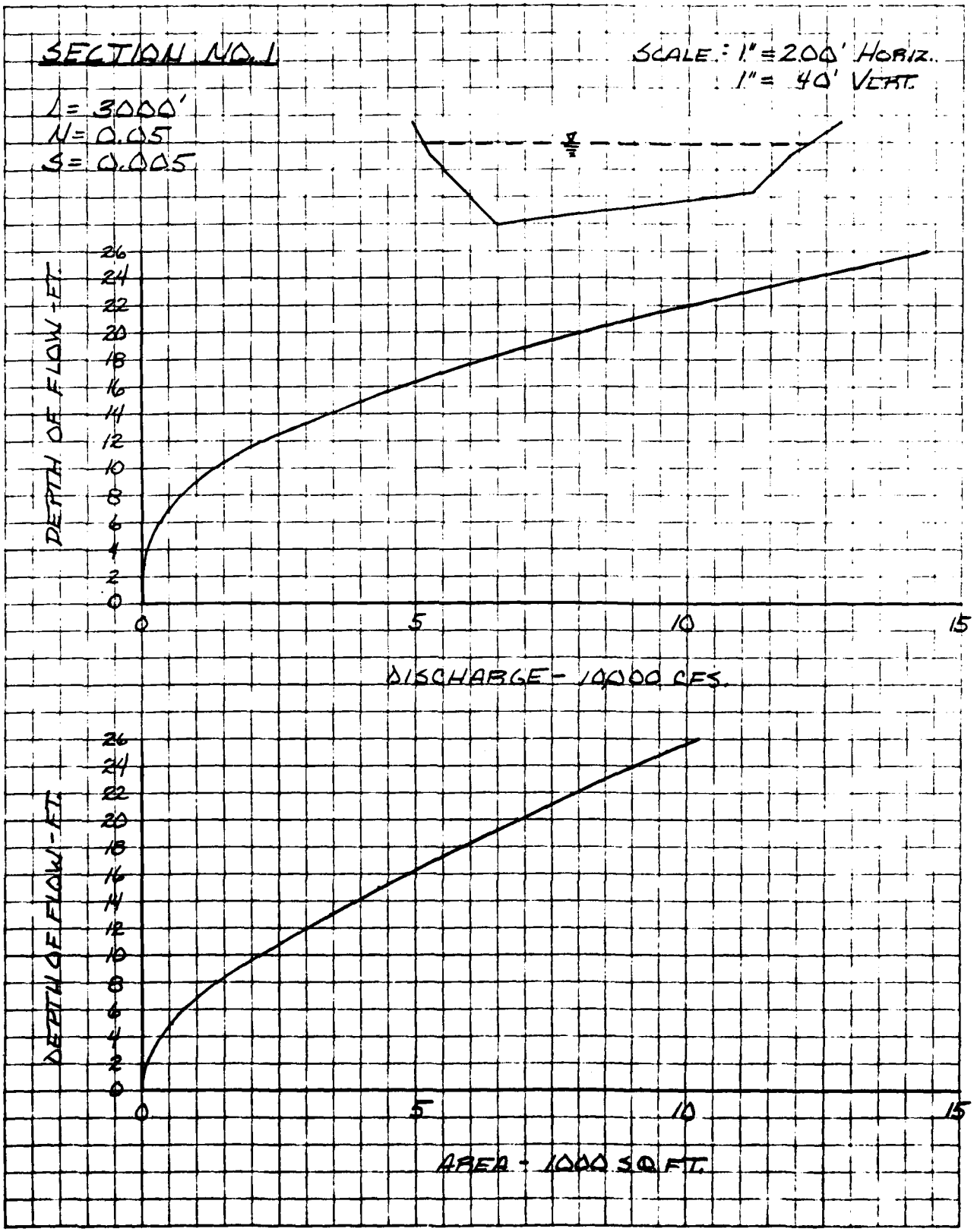
REACH OUTFLOW=QP2=108506 CFS
DEPTH OF FLOW=H2= 22.9 FT.

BY LRS DATE 1-19-81 **ROALD HAESTAD, INC.** SHEET NO 9 OF 17

CONSULTING ENGINEERS

CKD BY SAL DATE 1-21-81 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-054

SUBJECT WHITING RIVER DAM - FLOOD ROUTING



SECTION NUMBER 2

R.R. EMBANKMENT
(STORAGE CAPACITY WITHIN REACH)

HEIGHT (FEET)	SURFACE AREA (ACRES)	STORAGE VOLUME (ACRE-FEET)
1.0	1.61	0.8
2.0	3.22	3.2
3.0	4.83	7.2
4.0	6.44	12.9
5.0	8.06	20.1
6.0	9.67	29.0
7.0	11.28	39.5
8.0	12.89	51.6
9.0	14.50	65.2
10.0	17.69	81.3
11.0	20.88	100.6
12.0	24.07	123.1
13.0	27.26	148.8
14.0	30.45	177.6
15.0	33.64	209.7
16.0	36.83	244.9
17.0	40.02	283.3
18.0	43.21	324.9
19.0	46.40	369.7
20.0	54.55	420.2
21.0	62.70	478.8
22.0	70.85	545.6
23.0	79.00	620.5
24.0	87.15	703.6
25.0	95.30	794.8
26.0	103.45	894.2
27.0	111.60	1001.7
28.0	119.75	1117.4
29.0	127.90	1241.2
30.0	134.62	1372.5
31.0	141.34	1510.5
32.0	148.06	1655.2
33.0	154.78	1806.6
34.0	161.50	1964.7
35.0	168.22	2129.6
36.0	174.94	2301.2
37.0	181.66	2479.5
38.0	188.38	2664.5
39.0	195.10	2856.2
40.0	202.84	3055.2

STORAGE CAPACITY CALCULATED FROM SURFACE AREAS AT KNOWN ELEVATIONS.

SUBJECT WHITING RIVER DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 2

R.R. EMBANKMENT

H (FT)	W (FT)	A (SQ-FT)	R (FT)	S (FT/FT)	V (FT/SEC)	Q (CFS)
1.0	101	50	0.50	0.0036	1.12	56
2.0	103	150	1.46	0.0036	2.29	344
3.0	105	250	2.38	0.0036	3.18	795
4.0	107	350	3.27	0.0036	3.93	1375
5.0	109	450	4.13	0.0036	4.59	2065
6.0	111	550	4.95	0.0036	5.18	2851
7.0	113	650	5.75	0.0036	5.72	3721
8.0	115	750	6.52	0.0036	6.22	4668
9.0	117	850	7.26	0.0036	6.69	5686
10.0	119	950	7.98	0.0036	7.12	6767
11.0	121	1050	8.68	0.0036	7.53	7907
12.0	123	1150	9.35	0.0036	7.91	9101
13.0	125	1250	10.00	0.0036	8.28	10346
14.0	127	1350	10.63	0.0036	8.62	11639
15.0	129	1450	11.24	0.0036	8.95	12975
16.0	131	1550	11.83	0.0036	9.26	14352
17.0	133	1650	12.41	0.0036	9.56	15769
18.0	135	1750	12.96	0.0036	9.84	17221
19.0	137	1850	13.50	0.0036	10.11	18708
20.0	139	1950	14.03	0.0036	10.37	20228
21.0	141	2050	14.54	0.0036	10.62	21778
22.0	143	2150	15.04	0.0036	10.86	23357
23.0	145	2250	15.52	0.0036	11.09	24963
24.0	147	2350	15.99	0.0036	11.32	26595
25.0	149	2450	16.44	0.0036	11.53	28253
26.0	151	2550	16.89	0.0036	11.74	29934
27.0	153	2650	17.32	0.0036	11.94	31637
28.0	155	2750	17.74	0.0036	12.13	33362

CONTINUED ON NEXT PAGE

SUBJECT WHITING RIVER DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 2

R.R. EMBANKMENT

H (FT)	W (FT)	A (SQ-FT)	R (FT)	S (FT/FT)	V (FT/SEC)	Q (CFS)
29.0	157	2850	18.15	0.0036	12.32	35107
30.0	159	2950	18.55	0.0036	12.50	36872
31.0	161	3050	18.95	0.0036	12.67	38655
32.0	163	3150	19.33	0.0036	12.84	40456
33.0	165	3250	19.70	0.0036	13.01	42274
34.0	167	3350	20.06	0.0036	13.17	44109
35.0	169	3450	20.42	0.0036	13.32	45959
36.0	171	3550	20.76	0.0036	13.47	47824
37.0	173	3650	21.10	0.0036	13.62	49704
38.0	175	3750	21.43	0.0036	13.76	51598
39.0	177	3850	21.75	0.0036	13.90	53505
40.0	179	3950	22.07	0.0036	14.03	55424

MANNING COEFFICIENT=N=0.0500
STORAGE AT TIME OF FAILURE=S= 5000 AC. FT.
LENGTH OF REACH=L= 3500 FT

INFLOW INTO REACH=QP1=108506 CFS

BY SAL DATE 1-19-81 ROALD HAESTAD, INC. SHEET NO 13 OF 17

CKD BY DLS DATE 2/2/81 CONSULTING ENGINEERS JOB NO. 049 034

SUBJECT WHITING RIVER DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 2

R.R. EMBANKMENT

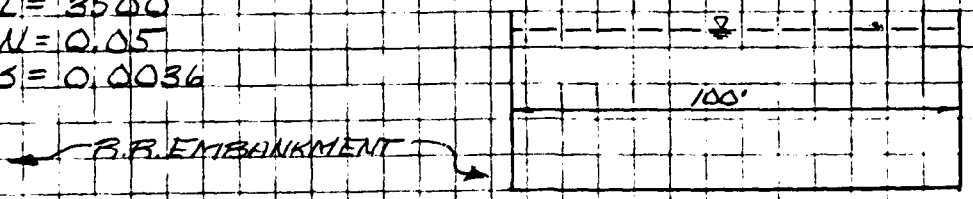
TIME (MIN.)	AVERAGE INFLOW FOR, ΔT (AC-FT)	TRIAL DEPTH OF FLOW (FEET)	AVERAGE OUTFLOW FOR, ΔT (AC-FT)	INCREMENTAL STORAGE, ΔS (AC-FT)	TOTAL STORAGE (AC-FT)	DEPTH OF FLOW END OF, ΔT (FEET)
2.0	294.5	21.6	31.3	263.1	520.2	21.6
4.0	285.5	24.4	68.8	216.7	736.9	24.4
6.0	276.6	26.4	79.6	197.0	933.9	26.4
8.0	267.7	28.0	88.0	179.7	1113.6	28.0
10.0	258.8	29.3	94.9	163.9	1277.5	29.3
12.0	249.8	30.4	100.8	149.1	1426.6	30.4
14.0	240.9	31.4	105.9	135.0	1561.6	31.4
16.0	232.0	32.2	110.3	121.7	1683.3	32.2
18.0	223.1	32.9	114.2	108.9	1792.2	32.9
20.0	214.1	33.5	117.5	96.6	1888.8	33.5
22.0	205.2	34.1	120.4	84.8	1973.6	34.1
24.0	196.3	34.5	122.9	73.4	2047.0	34.5
26.0	187.4	34.9	125.0	62.4	2109.3	34.9
28.0	178.5	35.2	126.8	51.7	2161.0	35.2
30.0	169.5	35.4	128.2	41.4	2202.4	35.4
32.0	160.6	35.6	129.3	31.4	2233.7	35.6
34.0	151.7	35.7	130.1	21.6	2255.4	35.7
36.0	142.8	35.8	130.6	12.2	2267.6	35.8
38.0	133.8	35.8	130.8	3.1	2270.6	35.8
40.0	124.9	35.8	130.7	-5.8	2264.8	35.8
42.0	116.0	35.7	130.4	-14.4	2250.4	35.7
44.0	107.1	35.6	129.9	-22.8	2227.6	35.6
46.0	98.2	35.4	129.1	-30.9	2196.6	35.4
48.0	89.2	35.2	128.0	-38.8	2157.8	35.2
50.0	80.3	34.9	126.7	-46.4	2111.4	34.9
52.0	71.4	34.6	125.2	-53.8	2057.5	34.6
54.0	62.5	34.2	123.4	-61.0	1996.6	34.2
56.0	53.5	33.8	121.4	-67.9	1928.7	33.8
58.0	44.6	33.3	119.2	-74.6	1854.1	33.3
60.0	35.7	32.8	116.7	-81.0	1773.1	32.8
62.0	26.8	32.2	113.9	-87.1	1686.0	32.2
64.0	17.8	31.6	110.9	-93.0	1593.0	31.6
66.0	8.9	30.9	107.6	-98.7	1494.3	30.9

REACH OUTFLOW=QP2= 47492 CFS
DEPTH OF FLOW=H2= 35.8 FT.

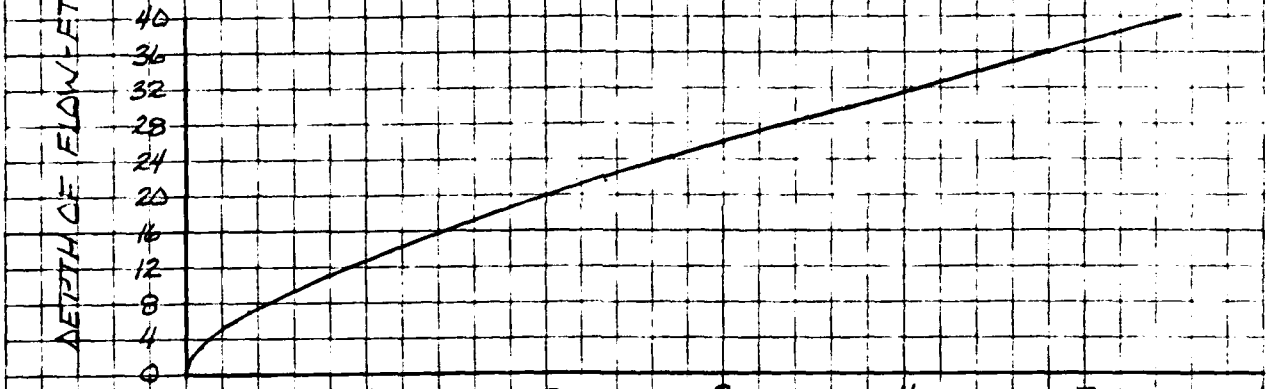
SUBJECT ..WHITING RIVER DAM - FLOOD ROUTING.....

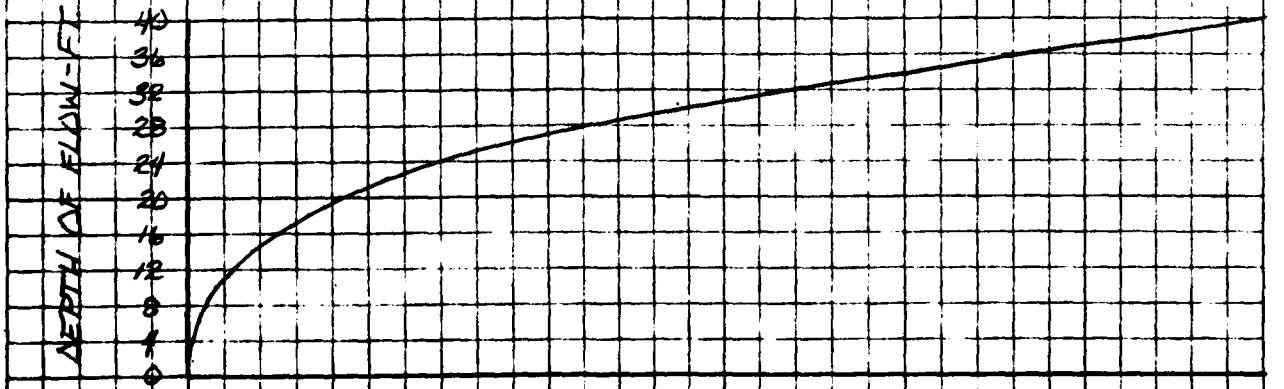
SECTION NO. 2 (R.R. EMBANKMENT) SCALE: 1" = 40' HORIZ.
1" = 40' VERT.

L = 3500'
N = 0.05
S = 0.0036



NOTE: THE OPENING SIZE WAS TAKEN FROM ASHLEY FALLS U.S.G.S. QUADRANGLE SHEET BECAUSE WE WERE UNABLE TO GET PERMISSION TO GO ONTO THE PRIVATE PROPERTY TO SURVEY A SECTION.





SECTION NUMBER 3

TOTAL SECTION
(STORAGE CAPACITY WITHIN REACH)

HEIGHT (FEET)	SURFACE AREA (ACRES)	STORAGE VOLUME (ACRE-FEET)
1.0	5.64	2.8
2.0	11.28	11.3
3.0	16.92	25.4
4.0	22.56	45.1
5.0	28.20	70.5
6.0	40.26	104.7
7.0	52.32	151.0
8.0	64.38	209.4
9.0	76.44	279.8
10.0	88.50	362.2
11.0	100.56	456.8
12.0	112.62	563.4
13.0	124.68	682.0
14.0	136.74	812.7
15.0	148.80	955.5

STORAGE CAPACITY CALCULATED FROM SURFACE AREAS AT KNOWN ELEVATIONS.

SUBJECT WHITING RIVER DAM-FLOOD ROUTING AT TOP OF DAM

SECTION NUMBER 3

TOTAL SECTION

H (FT)	W (FT)	A (SQ-FT)	R (FT)	S (FT/FT)	V (FT/SEC)	Q (CFS)
1.0	135	67	0.50	0.0035	0.92	62
2.0	270	270	1.00	0.0035	1.47	396
3.0	405	607	1.50	0.0035	1.92	1166
4.0	540	1080	2.00	0.0035	2.33	2512
5.0	675	1688	2.50	0.0035	2.70	4554
6.0	718	2384	3.32	0.0035	3.26	7775
7.0	760	3123	4.11	0.0035	3.76	11734
8.0	803	3904	4.86	0.0035	4.21	16418
9.0	845	4727	5.59	0.0035	4.62	21824
10.0	888	5594	6.30	0.0035	5.00	27958
11.0	930	6502	6.99	0.0035	5.36	34827
12.0	973	7454	7.66	0.0035	5.69	42442
13.0	1016	8447	8.32	0.0035	6.02	50815
14.0	1058	9484	8.96	0.0035	6.32	59960
15.0	1101	10563	9.60	0.0035	6.62	69891

MANNING COEFFICIENT=N=0.0600
STORAGE AT TIME OF FAILURE=S= 5000 AC. FT.
LENGTH OF REACH=L= 6000 FT

INFLOW INTO REACH=QP1= 47492 CFS
DEPTH OF FLOW=H1= 12.6 FT.
CROSS SECTIONAL AREA=A1= 8053 SQ.FT.
STORAGE IN REACH=V1= 445.7 AC. FT.

TRIAL REACH OUTFLOW=QP(TRIAL)= 43259 CFS
TRIAL DEPTH OF FLOW=H(TRIAL)= 12.1 FT.
TRIAL CROSS SECTIONAL AREA=A(TRIAL)= 7551 SQ.FT.
TRIAL STORAGE IN REACH=V(TRIAL)= 385.7 AC. FT.

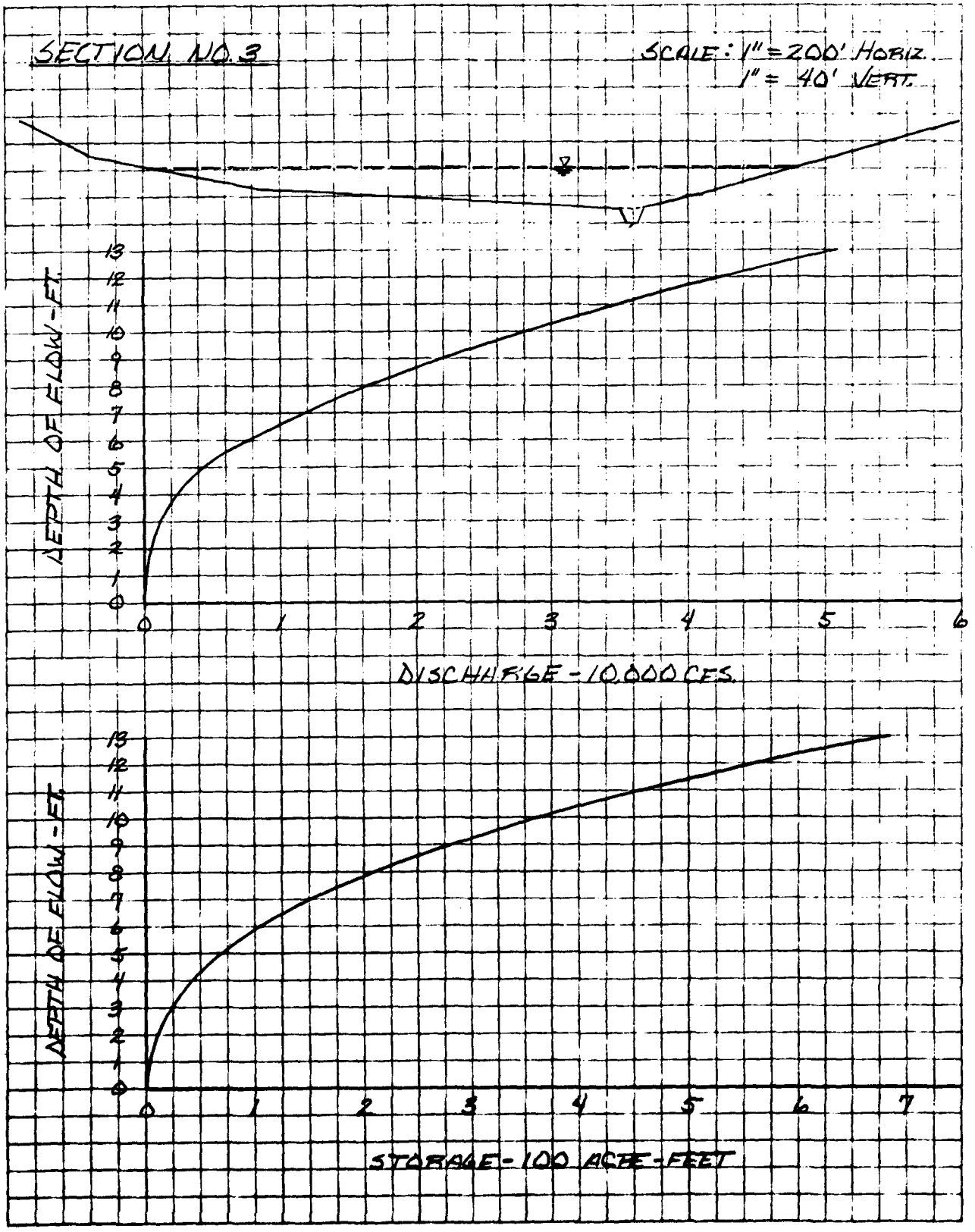
REACH OUTFLOW=QP2= 43544 CFS
DEPTH OF FLOW=H2= 12.1 FT.

BY L.E.G. DATE 1-21-81 **ROALD HAESTAD, INC.** SHEET NO. 17 OF 17

CONSULTING ENGINEERS

CKD BY SAL DATE 1-21-81 37 Brookside Road - Waterbury, Conn. 06708 JOB NO 49-C34

SUBJECT WHITING RIVER DAM - FLOOD ROUTING



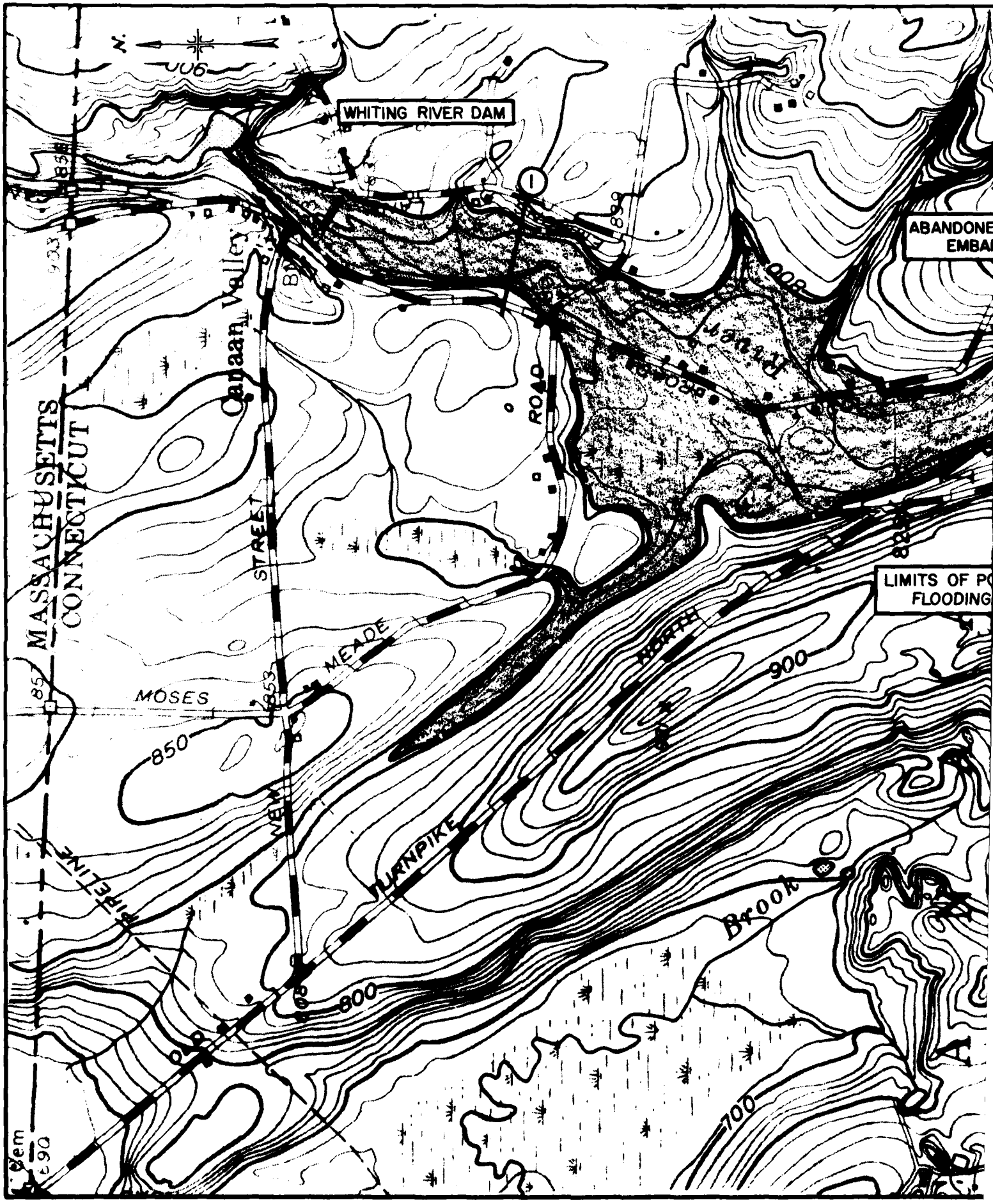
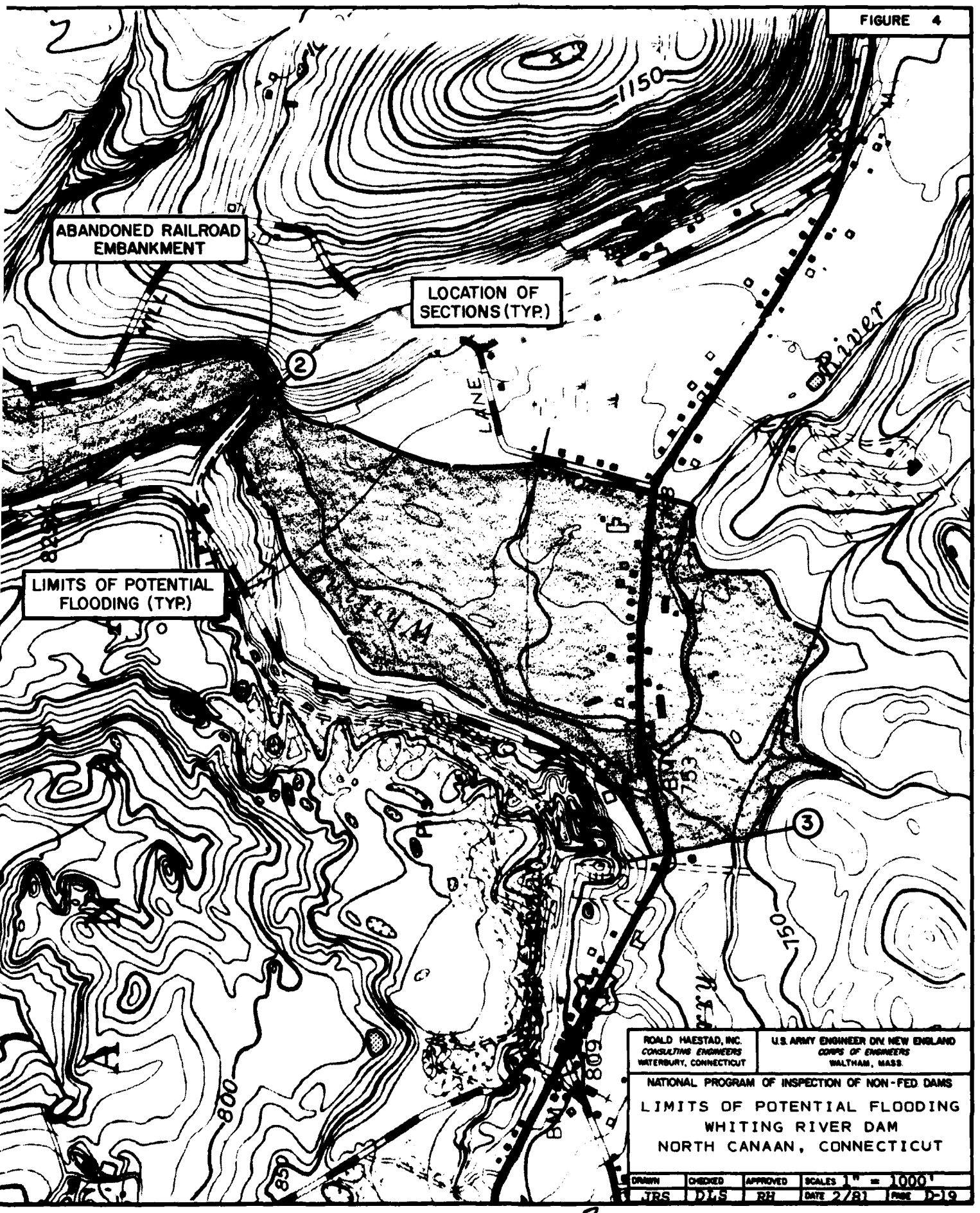

WHITING RIVER DAM
ABANDONE
EMBA
LIMITS OF PO
FLOODING
MASSACHUSETTS
CONNECTICUT
Canaan Valley
STREET
ROAD
MEADE
MOSES
NORTH
TURNPIKE
Brook
850
900
800
700

FIGURE 4



ROALD HAESTAD, INC.
CONSULTING ENGINEERS
WATERBURY, CONNECTICUT

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LIMITS OF POTENTIAL FLOODING
WHITING RIVER DAM
NORTH CANAAN, CONNECTICUT

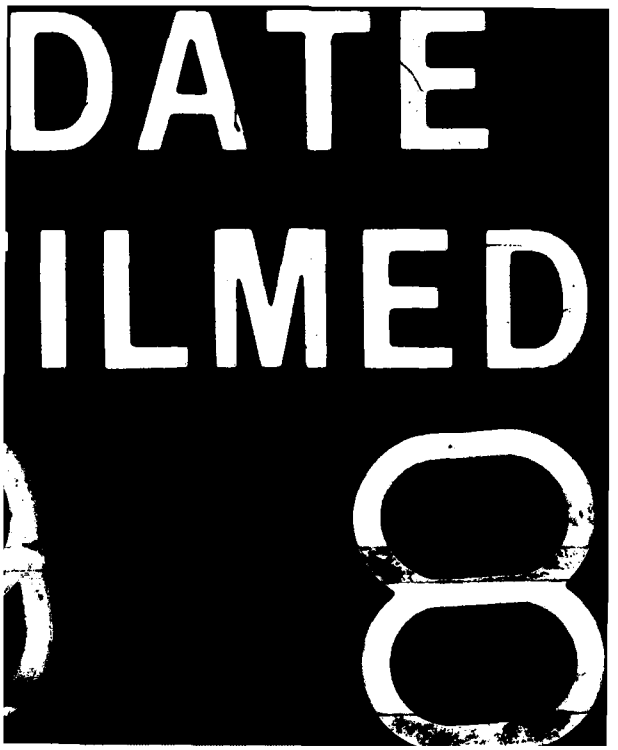
DRAWN	CHECKED	APPROVED	SCALES	
JRS	DLS	RH	1" = 1000'	
			DATE 2/81	PAGE D-19

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME


DATE
ILMED